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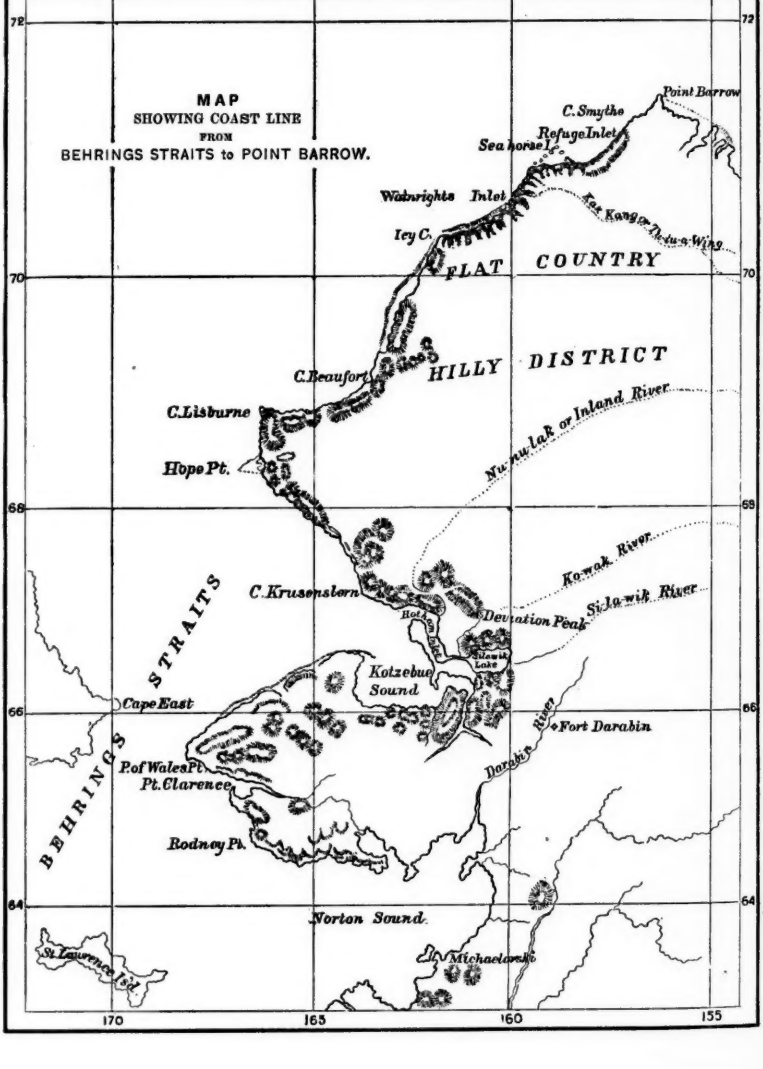
GEOGRAPHICAL NOTES.

NOTES ON POINT BARROW.

The following notes on Point Barrow, collected from various reliable sources, will be of interest, in view of the fact that it has been selected as one of the international stations for scientific observations, recommended by the recent Geographical Congress at Hamburg, and will probably be occupied by the United States at an early date: [ED.

Point Barrow is the northern extremity of the western portion of the American Continent, and consists of a low spit of sand and gravel projecting to the northeast. Its length is about four miles, and it is a little more than a quarter of a quarter of a mile in average breadth, but expands considerably at its extremity, where it rises to about sixteen feet in height and sends out to the east-southeast a low narrow ridge of gravel to a distance of more than two miles, succeeded in the same direction by a row of sandy islets inclosing a shallow bay of considerable extent. The assemblage of the winter huts of the natives is placed on the expanded and more elevated extremity where there is a thin layer of grassy turf. The number of inhabited huts in the winters of 1852–53 was fifty-four, reduced to forty-eight in the succeeding year, in consequence of the scarcity of oil to supply so many fires. Besides these, there were a few vacant huts and two dance-houses. The total population at the end of 1853 was 309, of whom 166 were males, and 143 females.

The sea in the vicinity affords several varieties of whale, the walrus, four different sorts of seal, the polar bear and some small fish. The inlets and rivers yield salmon, herring and the smelt, besides other kinds of large and small fish; and on


MAP
SHOWING COAST LINE
FROM
BEHRINGS STRAITS to POINT BARROW.
170
160
150
155
72
70
68
66
64
Point Barrow
C. Smythe
Refuge Inlet
Sea horse I.
Wainwrights Inlet
Icy C.
FLAT COUNTRY
HILLY DISTRICT
C. Beaufort
C. Lisburne
Hope Pt.
Nu-nu-lak or Inland River
Ko-wak River
C. Krusenstern
Deviation Peak
Si-la-wik River
Kotzebue Sound
Cape East
Fort Darabin
Darabin River
Pof Wales Pt.
Pt. Clarence
Rodney Pt.
BEHRINGS STRAITS
Norton Sound
St. Lawrence Isl.
St. Michaels

the land, besides an abundance of berries and a few edible roots, are obtained the reindeer, the inma (an animal which nearly answers to the description of the Siberian sheep), the brown or black bear, a few wolverenes and martens, the wolf, the lynx, blue and black foxes, the beaver, musk-rats and lemmings. In summer, birds are very numerous, particularly, geese in the interior, and ducks on the coast. The ptarmigan and raven remain throughout the winter, and the latter is the only living thing known to be rejected as food.

The articles in common use, for which the natives are indebted to strangers, are kettles, knives, tobacco, beads and tin for pipes. The tobacco bag is the constant companion of men, women and even children.

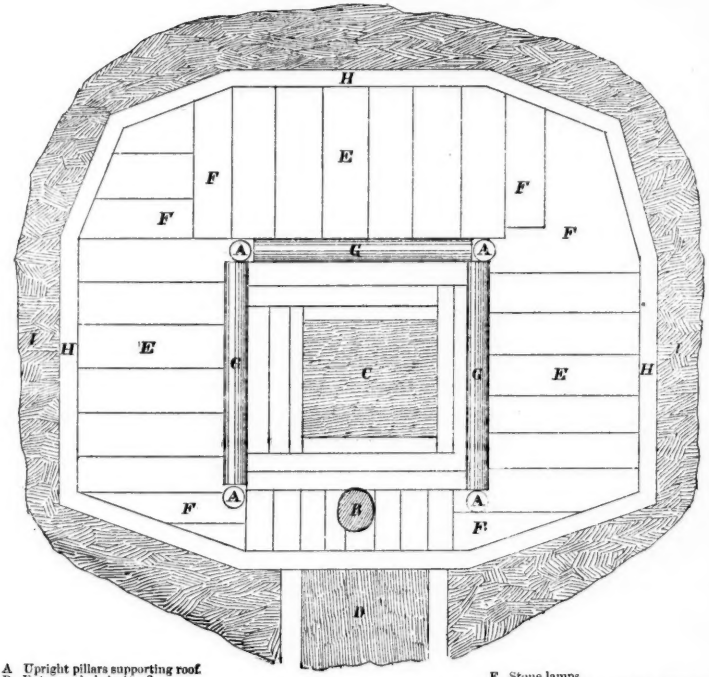
The winter huts at Point Barrow, form a scattered and confused group of grassy mounds, each of which generally covers two separate dwellings with separate entrances. The entrance to each hut is from the south, by a square opening at one end of the roof of a passage twenty-five feet long, and has a slab of ice, or other substance of convenient shape, to close it at pleasure. The passage, which is at first six feet high, descends gradually until about five feet below the surface of the ground, becoming low and narrow before it terminates beneath the floor of the hut The dwelling place is entered by a round aperture in the floor, on the side nearest this passage, and is a single chamber of square form, ranging in size from 12 to 14 feet from north to south, to 8 to 10, from east to west. The walls are of stout planks. The general form and arrangement will be understood by reference to the illustrations herewith.

The natives at Point Barrow divide the year into four seasons. The opening of winter is taken as the beginning of the year. During the winter the sun is not visible for about seventy days

The following notes show that it is comparatively easy for a properly equipped vessel to reach Point Barrow during any ordinary season:

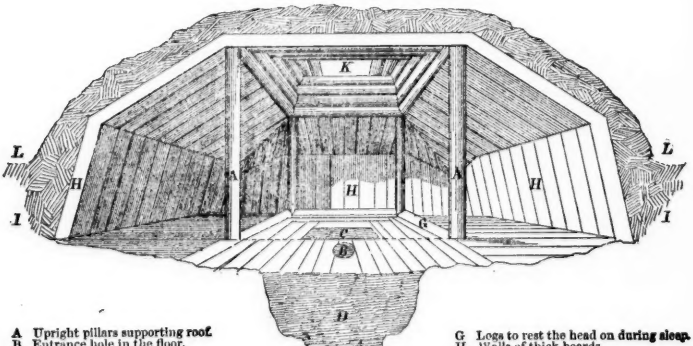
The "Blossom" left the harbor of St. Peter and St. Paul on July 5th, 1826. On the 18th, when off St. Lawrence Island, a current was found to be setting to the northeast, three-quarters of a mile per hour. On the 20th the Diomede Isles were reached and Kotzebue Sound on the 22d. Leaving that place on the 30th, the current off Port Hope was found to be superficial, that is, not extending twelve feet below the surface, but, at the surface it attained a rate, in the westerly direction, of three miles per hour. In the evening it slacked to one and one-half miles. On the 8th of August Cape Lisburne was reached and the edge of the pack was fallen in with, in latitude 71 °, 8′ north, on the 13th. The barge, under the charge of Mr. Elson, was sent to the northward on the 17th, and the "Blossom" returned to Kotzebue Sound on the 28th. The barge arrived here on the 10th of September, having reached Point Barrow in 71 ° 23′ 30″. In returning, she was driven on shore by the pack; but, the wind coming round to the south-southeast, she made her escape with much difficulty. The ice at Point Barrow was aground in four fathoms water, and was fourteen feet above the level of the sea. On the 13th of October the thermometer fell to 27 ° and the edge of the

Ground Plan of Esquimaux Hut.



A Upright pillars supporting roof.
B Entrance hole in the floor.
C Central space for cooking fire.
D Underground passage.
E Family sleeping-places.
F Stone lamps.
G Logs to rest the head on during sleep.
H Walls of thick boards.
I Earth embankment.

Interior of Esquimaux Winter Hut.



A Upright pillars supporting roof.
B Entrance hole in the floor.
C Central space for cooking fire.
D Underground passage.
E Family sleeping-places.
F Stone lamps.
G Logs to rest the head on during sleep.
H Walls of thick boards.
I Earth embankment.
K Hole in roof.
L Level of the surrounding ground.

sound began to freeze. The "Blossom" proceeded to sea and reached the Aleutian Islands on the 22d of October.

Captain Beechey remarks, "that off Icy Cape the current appeared to be influenced by the winds. Near Point Barrow it ran at the rate of three miles per hour and upward to the northeast, and did not subside immediately with the wind; but, the current here must have been accelerated by the pack closing in on the beach."

Her Majesty's ship, "Herald," Captain Kellett, arrived at Petropaulski on August 14th, and at Kotzebue Sound on the 1st of September, where she remained until the 29th. The "Plover," Commander Moore, left Honolulu on August 25th, reached the Island of St. Lawrence on October 13th, went into harbor near Tchutski Ness, in latitude 64° 20′, and longitude 173° 15′ west, on the 25th, and was permanently frozen in on November 18th. On June 13th, a clear lane of water enabled the ship to put to sea, and she arrived at Chamisso Island, Kotzebue Sound, on July 14th. The "Herald" joined the "Plover" in Kotzebue Sound on July 15th, and in company with the "Nancy Dawson," (Captain Sheddin's yacht) proceeded to sea on the 18th. On arriving at Wainwright Inlet the boats were dispatched from the ships on the 25th instant, and Lieutenant Pullen, in command of them, reached Point Barrow on August 4th, in company with the "Nancy Dawson." After seeing the boats fairly off on their route to the Mackenzie River, Mr. Shedden rejoined the "Herald" in Kotzebue Sound. The "Plover" passed the winter of 1849–50 in Kotzebue Sound and left on July 17th, and proceeded to the northward, leaving the ship off Wainwright Inlet on the 23d, in two boats. Captain Moon reached Point Barrow on the 27th, and went round it as far as Dease Inlet, and returned to Grantley Harbor, Port Clarence, on the 30th, where he passed the third winter. The "Investigator" left Oahu on July 4th, passed through the Aleutian chain of Islands on the 20th, and reached Cape Lisburne on the 29th. Entered the ice in latitude 72° 1′, north and longitude 155° 12′, west, and at midnight on August 5th, rounded Point Barrow in seventy-three fathoms water, ten miles from land. They got into open water on the American shore on the 7th and landed at Port Drew on the 8th.

The "Enterprise" left the Sandwich Islands June 30th, and passed through the Aleutian chain of Islands on July 28th. East Cape was reached on August 12th. The total set of the currents in the intervening days being north, 49° east, 127 miles. Passing Point Hope, Cape Lisburne and Wainrwight Inlet without seeing anything of the "Herald," "Investigator," or "Plover," the "Enterprise" got up to the ice on the 16th, and pushing through some brash ice, entered an open lane trending northeast and southwest, ten miles wide, up which she proceeded until she had gained a position northeast by north, 100 miles from Point Barrow and had forty-five fathom's depth of water-mud. Here her progress was barred, and after searching in vain for any opening on the southern side, she was, on the 21st, within thirty miles of the land without a prospect of making it. The ice hummocks here were frequently found to be twenty-five feet above the sea, and

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in one or two instances, as much as thirty feet was seen; but this was the greatest height. Here no bottom with sixty fathoms was found, and the temperature of the sea rose to 40 °. Seeing there was no hope of progress in this lane, the ship's head was turned to the southward, having traced the pack in a southeasterly direction for 145 miles from latitude 72 °, 45 ′, and longitude 159 °, 5 ′, west, with no signs of opening to east or southeast. Further progress to the eastward was considered impracticable this season.

The "Amphitrite," Captain Frederick, with Commander Maguire and a fresh crew for the "Plover," arrived at Port Clarence on the 30th of June. Leaving on the 12th, Commander Maguire proceeded to the north, and went up to Point Barrow in the boats, where a rapid survey of the harbor was made and sufficient depth of water for the "Plover" was found. he ret rned to that vessel, and succeeded in placing her in winter-quarters at Point Barrow, on the 21st of August, and was frozen in on the 24th of September. Before being frozen in he succeeded, in his boats, in reaching the coast to the eastward as far as the Return Reef of Franklin. The "Plover" did not get clear of her winter-quarters at Point Barrow until the 7th of August and on the 11th of the same month fell in with the "Amphitrite," Captain Frederick, and after replenishing her provisions returned to Point Barrow on September 7th. In attempting to prosecute the search easterly, an armed body of Indians of the Kokukun tribe was met with, and found so hostile that he was compelled to return; otherwise he would in all probability, have reached the "Enterprise," which vessel was stopped by the ice in Camden Bay, about eighty miles from the farthest point reached by him.

The "Plover" cleared her winter quarters on July 19th and, having received fresh supplies from Her Majesty's ship "Trincomaler," returned to Point Barrow on August 28th, being in no way impeded by the ice. The same evening the "Enterprise" arrived from the southward. This latter vessel had wintered in latitude 70 ° 8 ′, longitude 145 ° 29 ′, west; 245 miles to the eastward of Point Barrow, where she was beset on September 16th and frozen in on the 26th, in the pack in Camden Bay, four miles from shore. On the 10th of July, the whale-boat of the "Enterprise," under the command of Lieutenant Jago, was despatched from her to Point Barrow, at which point she arrived on the 24th. The ice broke up sufficiently to admit of the ship being moved on the 15th, and she reached Point Barrow on the 8th of August, Point Hope on the 10th; but owing to the prevalence of southerly winds and a strong northerly current, did not arrive at Port Clarence until the evening of the 21st, when they communicated with the "Rattlesnake," and found that the "Plover" had sailed for Point Barrow two days previously. The "Enterprise" left for Point Barrow on the afternoon of the 22d. On the 28th, they made the ice in latitude 70.0 °, and longitude 159.0 °, west, and reached Point Barrow the same afternoon, and, after communicating with the "Plover," returned to Port Clarence on September 8th, the "Plover" arriving the following day. Both vessels left for the south on the 16th.

"Through the large opening between the American and Asiatic continents,

occupied by the Aleutian Islands, there is an almost imperceptible set from the Pacific Ocean northward, the waters of which, retaining the impulse given them by the earth's rotation in a lower latitude, draw toward the American shores, and throw themselves into Norton Bay. They are thence driven with increasing force along the coast of America opposite the Island of St. Lawrence, diffusing themselves to the north of that island, to be carried, with lessened speed, through the Straits of Behring, after receiving, in the latter part of their course, the fresh-water stream falling through Grantley Harbor into Port Clarence. Spreading again over a larger space, they receive a further tribute from Kotzebue Sound, which is very palpable, off Port Hope. Again, in the latitude of Icy Cape, the earth's rotation gives them an easterly set, forming an almost constant current along the northern coast of America to Point Barrow, whence it pursues a direction northeast. Throughout all this course the current is subject to retardations, and even surface-drifts in an opposite direction, caused by northerly and northeasterly winds; but it is also accelerated by southerly and southwesterly gales.

From recorded observations, it appears that the coast, from Icy Cape to Point Barrow, is frequently packed with ice in the end of July and the beginning of August. The cause of this seems to be the occasional prevalence of westerly and northwesterly winds, which drive the pack upon the coast, again to be cleared away by the northeast current along shore, as soon as these winds have spent their force; and southerly and southeasterly winds will have the opposite effect of driving it in a more northerly direction, and leaving the navigation more open than usual. At Icy Cape, the current on Captain Beechey's chart is marked as running both ways along shore, but not, it is presumed, with the regularity of a regular tidal ebb and flow. During the continuance of an easterly gale, from the 29th of July to the 5th of August, and a fresh breeze following for two days at that cape, floating substances were observed to drift slowly to leeward, while the waves were short, irregular and much more broken than usual, to a distance of twelve miles off, as if caused by a weather current. This may, however, be partly owing to the shoals extending four miles off the land. On the 23d, a whaling vessel stood within six miles of the shore, tacked and stood out again, making such progress to windward as a sailing vessel could only do when favored by a strong weather current.

From Icy Cape to the Seahorse Islands, in addition to drift-wood, there is strewn along the beach a quantity of coal, which, though much water-worn, may, in some of the indentations, be collected in sufficient abundance and bituminous enough to make an excellent fire for cooking. It is of the sort called candle coal, and some of the pieces are sound enough to be carved by the natives into lip ornaments. At the Seahorse Islands it is found as fine as small gravel, and, on digging into the beach, it is seen to form alternate layers with the sand; but, between Wainwright Inlet and Icy Cape, it is gathered in knots of a convenient size for fuel. This may be taken as a farther evidence of the set of the current, as the nearest known point whence the coal is brought is that marked on the chart Cape Beaufort.

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The whole extent of the coast from below Icy Cape to Point Barrow is bordered by a beach of gravel, which has likewise a southern origin, and determines the form of the continent, offering, as it does, an effective barrier to the encroachment of the sea, which would otherwise speedily undermine the earth cliffs behind. All that can be seen from the seaboard landward is a flat, alluvial plain, seldom exceeding twenty feet in elevation, and containing numerous lagoons of fresh water, but without a tree or bush to relieve the view."

It will be seen from the foregoing abstracts that the navigation of the Arctic Sea, between Behring Straits and Point Barrow, is comparatively easy to vessels fitted for ice navigation. The current of warm water from the Pacific sets continually to the northeast throughout the summer months, and forms a lane between the pack and the land, which enabled the Blossom's barge, on August 21, 1826, to reach Point Barrow.

Thos. Shedden, in a schooner yacht of 140 tons, rounded the Point on August 4, 1849.

The Investigator, Commodore McClun, on August 5, 1850.

The Enterprise, Captain Collinson, on August 20, 1850.

The Enterprise, Captain Collinson, on July 25, 1851.

The Plover, Commodore Maguire, and wintered there, being frozen in September 24, 1852. The Plover left her winter quarters August 7, 1853; returned to her winter quarters, September 7, 1853; again left her winter quarters, July 19, 1854; returned to her winter quarters, August 28, 1854.

The Enterprise, returning from the eastward, rounded the Point August 8, 1854; and returned from Port Clarence, August 28, 1854.

The season of 1854 was undoubtedly the most open, the ice being so far from the Point that the whaling ships were enabled to fish off it.

The season may be considered to be open from the beginning of July to the middle of September. The pack is usually met with off Icy Cape, and, should westerly winds have prevailed, and forced the pack into the shore, a vessel will do well to wait until the wind subsides, when the current will be sure to open the lane between the land and the pack. Easterly winds check the current, and, after a continuation of them, there is a set along shore to the southward. Some natives got adrift on the ice, in 1853, and were carried by this set to the southward of Icy Cape, the land being always in sight.

In both years in which the Plover wintered at Point Barrow, the ice around the Point was broken up and swept to the northward by southwesterly gales. At times no ice could be seen from the masthead. In 1853, this disruption occurred in December, and caused the water to rise 3½ feet above the highest spring tide. The temperature at the same arose to 30° F. In January, 1854, the same thing occurred, the thermometer on this occasion rising to 27°. During both winters a water sky to the northwest was generally observed from the ship, unless after a long continuance of northwesterly winds or calm weather. There is but little rise and fall of the tide, 0.7 inches being the average. With fine weather or easterly winds,

they are very regular, but southwest gales upset them altogether.

Esquimau whale fishing commenced on May 7, 1853, the open water being four miles from Point Barrow, extending in an east-northeast and west-southwest direction. with a depth of ten fathoms water.

Between the 4th and 7th of July, about thirty "oomiaks," carrying about 150 people, went to the eastward. The ship swung to her anchor on July 25, and the ice was in motion in the offing on July 30.

The Plover's log shows that, in 1852–3, open water was seen on twenty-seven days, between October and April, and in 1853–4, on seven days only, while the indications of open water occurred during the same period in 1852–3 on fifty-seven days, and in 1853-4 on sixty two days. December, January and February appear to be the months during which the ice is more frequently in motion.

It is remarkable that, though the winter of 1852–3 was warmer than the ensuing one, the Plover was detained by the ice in her winter quarters until August 7, whereas in 1854 she made her escape to the southward on July 23, and the ice during the summer was so far off the Point that the whale ships fished off it.

On July 10, the water along the coast was sufficiently open to send the whale boat to Point Barrow. On the 15th the ice broke up, which was three days earlier than at Point Barrow. The ship left Camden Bay on the 20th, but, owing to obstruction by the ice, did not reach the Point until the afternoon of August 7.

In 1821, Point Barrow was reached, in the month of July, by Captain (afterward Sir John) Franklin, during his first overland journey to the shores of the Polar Sea.

In 1837, Messrs. Dease and Simpson made a boat journey from the Mackenzie River to Point Barrow. Leaving Fort Chipewyan on June 1, they reached Point Barrow on the 4th of August, and returning arrived at Fort Good Hope August 28.

INTERESTING DISCOVERY IN GREENLAND.

Mr. Komerup, who accompanied Lieutenants Jensen and Hemmer in their scientific investigations, as Geologist, reports having met an extraordinary and at present unexplained phenomenon.

He states that, in the course of his explorations in the ice-fields of the interior, he ascended a hill, the top of which was covered with flowers and vegetation. Several kinds of small animals were also found there. His detailed report will be looked for with interest.

RUSSIAN GEOGRAPHICAL SOCIETY.

The annual re-union of this body took place January 23 to February 4. The session opened with an account of the labors of the Society for the year 1879, from

which it appears that it has been especially active in scientific enterprises, extending throughout most of the empire. The Society lost during the year several of its most active members, notable among whom are named: Mgr. Innocent, one of the Society; Prince Bariabusky, and Professor Brandt.

In distributing the annual medals, it was found that there was no one entitled to the Grand Constantine Medal, which should have been awarded to the best work on Statistics. The medal of Count Lutke, was awarded to M. Inostrantrew. Gold medals were given to MM. Zolotwitsky and Orlow, for their works on Ethnology.

GEOGRAPHICAL SOCIETY OF FRANCE.

The membership of this society, on the 31st of December, was reported by its secretary as numbering 1,915, while in 1864 the number of members was only 303.

The Society includes among its members the rulers of nine countries, the most active of whom is Dom Pedro of Brazil.

METEOROLOGY.

COMPLETENESS AND VALUE OF INTERNATIONAL WEATHER REPORTS AND WEATHER CHARTS.*

Many years ago, the elder Herschel said: "In endeavoring to interpret the weather, we are in the position of a man who hears at intervals a few fragments of a long history, related in a prosy, unmethodical manner, while a host of circumstances omitted and a want of connection between the parts prevent the hearer from obtaining possession of the entire story." The old astronomer, accustomed to the exact methods and the multiplied observations in which his own science reveled, could ill brook the guess-work, or patiently decipher the vague and scattered material of the meteorology of his day. To supply the lack of which he complained—to furnish the missing fragments of this aërial history, to bring in the omitted circumstances and connect them in one harmonious whole—is the object of the International Weather Service, as originated, organized and operated in the United States.

It is our present purpose to describe or review this vast, novel system of *international* research, which, in very recent years, springing up almost silently into vigorous existence, enlisting the coöperation of numerous governments and

* We call the particular attention of our readers to this article, as being the most comprehensive and complete history and exposition of the workings and advantages to the commerce of the world, of the International system of weather reports, yet published in any magazine of this country or Europe.—[Ed.

many public and private laborers, both on the land and the sea, has already stretched its network of observers over the larger habitable part of the Northern Hemisphere, and aims at nothing less than to put the atmosphere in every attainable quarter of the globe under tribute. A system of such comprehensive and ambitious scope might well stagger the mind, and its very proposal raise many questions of feasibility hard to answer, did we not remember that the atmospheric ocean is a unit whose parts and elements, "distinct as the billows, yet one as the sea," wayward and lawless in their motions as they may appear, are, nevertheless, so nicely adjusted as to form an *orderly structure*—a beautiful and mighty mechanism; working, however inscrutably, obedient to laws impressed upon it by the Hand from which it originally came—exposed everywhere to man's inspection, and announcing to him both the play of its ponderous machinery and its subtler processes, by sounds and signals familiar to all. While the most visionary zealot of science could not dare hope ever to perfect such a research, the humble laborer may hope to gather much from its patient pursuit. For it does not seem incredible that, with a system whose chains of observations cover so expansive a field, many discoveries may be made, which ages of circumscribed investigation could never promise. If the ripple made on the placid bosom of the lake extends its circle of disturbance from shore to shore, the storm makes itself widely felt and rests not until it has agitated the whole aërial sea. That sea has its flood and ebb tides, its system of circulation—horizontal and vertical, and its normal exchanges of heat and cold, not less than the Atlantic and Pacific Oceans have their currents and their counter-currents moving within given limits and maintaining a substantial equilibrium. If, then, the Atmosphere, over large portions of the globe, can be *simultaneously* observed, and its phenomena represented to the eye in *graphic* forms or diagrams, so that the student can get clear ideas of its movements and changes, and trace them to their origin and end, as well as leisurely examine the seemingly eccentric, but orderly, manœuvres of its great forces, executed on the surface of the earth regardless of local or national boundaries, the chief difficulty of the meteorologist is removed; the fog, which for centuries has overhung his science, lifts, and he enters upon a new, auspicious era of research, pregnant with promise. The ripened results of such a work may aspire to rank with other scientific finalities.

But the first fruit it has yielded can now be seen in the daily publications of international meteorology at Washington—chiefly in the beautiful, colored International Weather Chart for the Northern Hemisphere. This chart, it is true, is only a weapon of research—an *instrument* to facilitate investigation; but, as we shall presently see, it is a powerful instrument—as the telescope to the astronomer. If the great English poet could represent Galileo, "the Tuscan artist," with his rude "optic glass"—its polished face mirroring the moon—as full-armed,

> "At evening, from the top of Fesolé,
> Or in Valdarno, to descry new lands,"—

we may not inaptly view the modern investigator, having this *Chart*, on which the atmospheric movements and mechanism are cast and depicted—as equally

well-armed for descrying these majestic operations and benign arrangements of the aerial world, which must awaken in every true mind unutterable admiration of their Author, Who "commandeth and raiseth the stormy wind," even as of old, when tossed on the waves of Gennesareth, in omnipotent tones, He bade it "Be still!"

The immediate official origination and organization of this new system of international simultaneous observations are due to the skill and earnest labors of General Albert J. Myer, the Chief Signal Officer of the Army. In 1872, when the present Weather Bureau under his direction was struggling into existence and effectiveness, that officer had extended the system of observations beyond the confines of the United States, by inviting "all ship-owners and those interested in commerce" and all "ship-captains and others making voyages to sea to make the necessary observations at the stated times,"* furnishing blanks to such as were willing to accept the invitation, as a number did. The object of this effort was to bring the largest portion of the atmosphere possible under simultaneous research; but this required greater coöperation and concentration than any one nation could effect. Accordingly, early in the following year, General Myer exerted himself to prepare a scheme for concerted international meteorology and to secure the organized effort of all the nations in carrying it out. With these views, the Chief Signal Officer, in 1873, repaired to Vienna to attend the International Meteorological Congress, convened in September of that year; and, as the official representative of the United States, he laid before the Congress a proposition to the effect, "That it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suitable for the preparation of synoptic charts, should be taken and recorded daily and simultaneously at as many stations as practicable throughout the world."† This proposition—the first ever made under such auspices—involving the immediate, actual undertaking, on a world-wide scale, of a work whose magnitude had so long intimidated others, met with the unanimous concurrence of the Congress. And in November, 1873, a few weeks after that body adjourned, the Chief Signal Officer was enabled to state to the Secretary of War, at Washington, that arrangements had "already been made with the meteorological offices at St. Petersburg, London and Constantinople to commence the exchange by mail of one, daily, simultaneous report, taken over the vast territorial extent of the Russian and Turkish empires, the British Islands and the United States." Energetic efforts were then made to perfect and extend this comprehensive and arduous enterprise, now for the first time set on foot through the zeal of its American author. The example of the Russian government and others, of entering into this work as proposed at Vienna, was rapidly followed by the governments of Austria, Belgium, Denmark, France, Algiers, Italy, the Netherlands, Norway, Spain, Portugal and Canada. So that, in the fall of 1874, General Myer officially reported: "The concurrence of so many nations, representing a territory cov-

* Report of the Chief Signal Officer for 1872, p. 86.
† Report of the Chief Signal Officer, 1873, p. 311.

ering the larger inhabited portions of the Northern Hemisphere, seems to put beyond question the ultimate success of the undertaking to secure daily a simultaneous report of the meteoric conditions over the greater part of the earth's surface," and then, November 1st, announced that "the issue of the International Bulletin of Simultaneous Reports had been commenced."† The national coöperation of Greece, Norway, Dutch Guiana and Japan, and that of numerous scientific associations, speedily ensued and greatly enlarged the scope of the new service planned and prosecuted at Washington; and, in 1875, the Naval forces of the different powers were solicited to extend the plan of simultaneous reports upon the seas. The Sandwich Islands, the West Indies, the East Indies, Mexico, and the United States Navy with the Medical Corps of the Army, in 1876 and 1877 became actively enlisted in rendering daily reports taken simultaneously with those of the Signal Office at Washington, and helped to swell the volume of observations desired by its chief. The scheme which he had laid down and carried to Vienna in 1873, and which had been there accepted by the Meteorological Congress, has been steadily pursued, with steadily increasing auxiliaries and an ever-widening horizon of promise, from its inception to this present time.

The Northern Hemisphere, hitherto the chief field of its investigations, is eminently the *land-hemisphere* of the globe, containing, according to the estimates of geographers more than three-fourths of the entire solid terrestrial surface. "If we compare the *North with the South Temperate Zone*, says Prof Ansted, the English geographer, "we find the land nearly *as thirteen to one.*" The international weather system, in covering as it now does, the entire North Temperate Zone, excepting some sparsely-settled portions of Central Asia, already spans nearly thirteen-fourteenths of the temperate regions of the earth, upon which are congregated by very far the largest part of the human family, and where all the greatest interests of man center—the regions, in a word, in which all the practical applications of meteorology can most effectively and extensively subserve his welfare.

Just here, it may be proper to state, the novelty or originality of this system, as it was proposed for the first time at Vienna in 1873, chiefly consists in the collection of *strictly simultaneous* observations, both on land and sea, and their utilization in studying the atmosphere *as a whole*. Accuracy and science alike require us to distinguish between "simultaneous" observations and those usually termed "synchronous." The term "synchronous" has often been used to characterize observations taken at a given hour over large areas, but with the understanding that each observer follows *his own local time*. An international corps of observers, stationed on different meridians, taking "*synchronous*" observations, would, therefore, be all reading their instruments at *different moments or hours of time*: an observer at St. Louis would read six hours after the London observer; and those separated by a greater or less distance than divides these two, would report at correspondingly greater or less intervals, so that their reports would not

† Report of the Chief Signal Officer, 1874, p. 88.

be strictly adapted for inter-comparison, nor could they faithfully mirror the aerial movements, the translations of storms, etc., as they actually occur. However useful *synchronous* reports might be, they could never yield the results obtainable from the *simultaneous*, as adopted at Vienna—a distinction which, we find was once forcibly remarked by Admiral Fitzroy. That honored meteorologist was never the author nor founder of any International system of simultaneous reports, but he said in 1863: "In General Sabine's recent lecture at Cambridge on Magnetism, the term 'synchronous' is applied to observations made at the same local hour, around the world, but these are *not simultaneous*. Truly, indeed, these are synchronous, but not in the sense that is required for occurrences happening simultaneously or synoptically, referred to time or view, at one place only, and on one meridian." [Fitzroy's Weather Book, p. 103, London 1863.] The value and beauty of every weather system, especially of an international weather-system, (some of whose observers must be at antipodes, and, hence, if observing at "*the same local hour,*" must report twelve hours too soon or too late) are clearly dependent upon its securing observations taken every day when *the sun reaches a given spot in the heavens*. Otherwise, confusion, maziness and uncertainty attach to the very data from which, by inter-comparison, clear light is sought, and the study of the atmosphere as a unit fails. The great desideratum is to get such data as, when charted graphically, will afford the meteorologist a *bird's eye* (synoptic) *view* of the aerial ocean. This is secured by the plan originally proposed by General Myer at Vienna. With this explanation, we hasten to describe the practical execution of this plan at the Army Signal Office in Washington.

The "*Bulletin of International Meteorological Observations*" may first engage our attention. The prime feature of this publication, as intimated, is that all the observations it records, are *taken simultaneously*, or strictly at the *same actual moment of time*, in every part of the world. The moment fixed for observing is 7:35 a. m. Washington mean time, which is 0:43 p. m. Greenwich mean, time 0:53 p. m. Paris mean time, 1.37 p. m. Berlin mean time, 1:49 p. m. Vienna mean time, 2:44 p. m. St. Petersburg mean time, 1:33 p. m. Rome mean time, 6:36 p. m. Calcutta mean time, 10:23 p. m. Melbourn mean time, 10:02 p. m. Tokei (Yeddo) mean time, 2:12 a. m. Honolulu mean time. 7:25 a. m. Toronto mean time, 6:07 a. m. Mexico mean time, etc., etc. Thus, whether it be morning, noon, afternoon, evening or night, when the fixed moment arrives at any station, the observations are taken—without respect to the local position of the sun—so as to give data, from which the student may approximately chart the conditions of the atmosphere as they actually co-exist in every part of the wide field of observation, at one and the same point of time.

The *simultaneousness* of all the observations that enter into the *Bulletin* is the feature of greatest importance. For it is clear, if the observers of one country read off their instruments at an interval of time different from that at which other observers did the same, their reports would not be suitable for comparison, and might seriously mar the integrity of the general result. If all the co-operators took

their observations, say, at 6:00 a. m. mean time of the capitals of their respective countries, their reports would be confusing and incomparable, and no accurate deductions could be based upon them. Such reports might be *synchronous*, but not *simultaneous*, in the strict sense in which we here employ the latter term. The object of all meteorological observation is to get the facts necessary to construct, each day, a graphic sketch (if we may so speak of photographic faithfulness) of the atmosphere as it is, and not a distorted view of it. It is manifest, therefore, that nothing less than observations *strictly simultaneous*; or as nearly so as the imperfections of artificial time-keepers will admit, can ever adequately or satisfactorily meet the requirements of such research.

This "Bulletin" combines more than thirty series of observations. These are the Algerian, Australian, Austrian, Belgian, British (with Marine series), Canadian, Costa Rican, Danish, French, German, Greek, Indian (East), West Indian, Italian, Japanese, Mexican, Netherlands, Norwegian, Portugeese, Russian, Spanish, Swedish, Swiss, Turkish, United States, and United States Naval Series, with the Pacific Mail S. S. Co. Marine series, and other marine series, as those of the White Star Line, the Occidental & Oriental S. S. Co., the North German Lloyd of Bremen, the American S. S. Co., the Red Star Line and the Allan Line. The number of observers reporting exceeds 550, not including those at the Cape of Good Hope, Mauritius, Melbourne, and Hobart Town, in the Southern hemisphere, and one or more, whose reports form the British "Subseries." This large co-operative force, taking simultaneous observations every day, enter the readings of their instruments and remarks on the weather upon their blank forms, or on suitable sheets, and forward them by mail to Washington. The observations, when received at the office of the Chief Signal Officer there, are collated, tabulated, revised and printed, making a daily Bulletin, quarto size, of 12 pages.

The accuracy and skill with which the observations are taken, as also the estimate put upon the practical value ultility of the results deducible from them by those best fitted to judge, may be approximately inferred by glancing at the various classes of observers so diligently engaged in this international work. These include forty-nine naval commanders, fifty-one steamship and ship captains, two ministers of public instruction, and twenty-three directors of royal and imperial observatories, heads of meteorological institutes, and secretaries of central meteorological councils and societies, with their respective bands and corps of observers, representing hydrographic officers, normal schools, physical societies, astronomical observatories, naval academies, engineers, etc. The zeal, attainments and facilities enjoyed by such men as form the international corps ought alone to suffice as both a guarantee and an assurance that their work will be of the most exact and most useful character. Probably, no equally expert and experienced force of voluntary collaborators were ever engaged in any similar enterprise. Before losing sight of the Bulletin, we should notice the items of the observations which appear on its pages. These, as given in the reports of the observers at

land-stations, consist of the barometer readings reduced to sea level, and given both in inches and millimeters; the readings of the thermometer both by Fahrenheit and Centigrade scale; the relative humidity of the air, per cent.; wind, direction, velocity and force; the clouds, both upper and lower, and both the amount of cloud and direction of its motion, the rainfall and melted snow in the previous twenty-four hours in inches and millimeters; and the state of the weather, at the taking of the observations, including notes of fog, mist, rain, snow, color of sky etc The barometric readings in separate columns, are given as reduced to freezing and their respective standards.

In the Marine series—the reports by ship captains—the sea-swell is noted, in addition to the other items; and each ship's position at the time of observing is entered with her name. The sea-swell is an important item as sometimes furnishing a strong indication of the passage of a storm-center, while yet distant, and may afford a clue both as to its direction and intensity.

The records which appear in the *Bulletin* are copied from the regular exchanges of the office, and, with each series, the necessary notes as to wind-scale used, correction etc., are supplied. To secure the greater accuracy and uniformity from marine observers, all captains are invited to compare their barometers with a standard barometer, placed by the chief signal officer (kept under lock and key) in the Merchants' Exchange reading room in San Francisco and at the Maritime Exchange in New York.

The first number of the present series of the International *Bulletin* was published at the Washington office, January 1, 1875, the accomplishment of which was made possible by the data furnished from different parts of the world, in response to separate letters addressed by General Myer to the different nations in 1873.

The first step toward the utilization of the great mass of data, daily received and recorded in the *Bulletin*, is to chart it. The *International Weather Map*, presenting in graphic and partly pictorial forms the atmospheric conditions throughout the immense area of co-operative research, is an epitome of the *Bulletin*, and enables the eye of the student easily to catch the salient features of the weather. Without it, the *Bulletin* with its long columns of figures would but slowly repay his study, if it did not confuse his mind with the very multiplicity of items. With it before him, almost at a *coup d'œil* he can distinctly trace the great areas of high and low pressure, the belts of high and low temperature, the predominant air-currents, rain and cloud-areas; he can locate the troughs and crests of the great aerial waves, and can distinguish the centers, dimensions, outlines, and even estimate the intensities, of the cyclonic storms, that are simultaneously sweeping across his vast field of vision. This invaluable aid to the study of the data is first drawn on a large, tinted sheet, or blank map, the map being on a Polar projection, twenty-two inches in diameter, covering the northern hemisphere, and representing fragments of Africa and Australia. This large map, printed in blank form, for daily use in the office, first receives the entries of the observations tabu-

ated in the *Bulletin*. The cartographer, having received the day's bulletin, transfers to each station on his printed and colored chart the bulletined reports belonging to that station, representing the winds by arrows, the cloudy and clear weather by appropriate symbols, and the barometric and thermometric data by numerical figures. When all the items are entered on the tinted chart in their proper places, he proceeds to draw the Isobars (or lines of equal pressure) in red, and the Isotherms (or lines of equal temperature) in black. These lines, shaped by the recorded data, when completed, bound and define the great areas of high and low barometer, and also those of high and low thermometer, and indicate the position, contours and centers of the prevailing storms. The barometric areas are graded and marked "HIGH," "HIGHER," "HIGHEST," and "LOW," "LOWER," "LOWEST," and the chart is done.

When thus filled up and finished, if approved, the Isobaric and Isothermal lines are traced on tracing linen, laid over the chart, and then transferred by the heliotype process to a reduced form of the original chart, upon which the Isobars appear in black and the Isotherms in red. This reduced form of the original chart is finally printed and published, as an accompaniment to the Bulletin. Upon the *published* chart, only the Isobaric and Isothermal lines, with their numerical values, are given. But, with the aid of the Bulletin, the reduced chart (eight and a half inches in diameter) is sufficient for general use among the cooperating observers, to all of whom it is sent.

We have spoken of the International Weather Chart as an invaluable auxiliary in the study and utilization of the International Bulletin. This chart is as important to the meteorologist, as the ocean-chart is to the navigator. Not only does it give him a clear idea of the meteorological conditions as they coëxisted at the moment of observing on any particular day, but, with the series of daily charts before him, by running the eye over them successively, the developments of the weather, the movements of the storm-centers and their velocities and influences become apparent. The inspection of several such, successive, daily, graphic charts familiarizes the eye with the phenomena of the atmosphere, while it also enables the student to *picture them in motion* before him and to watch the play of the mighty forces which conspire to produce them. In a word, the whole series of the charts based on the combined data of the International Bulletins presents, as it were, a panoramic view of the atmospheric ocean, as it rolls its ever restless waves and bears its revolving gales around the Northern Hemisphere.

Better to understand the construction and use of these daily charts, it should be stated, that they contain (1) Data, as appearing in the International Bulletin of similar date (2) Gobars, in black, exhibiting the atmospheric pressure at sea-level, which are charted from simultaneous data as represented by the several observers, (3) Gotherms, in red, exhibiting the temperature of the air, similarly charted—the lines being broken or dotted wherever the data are incomplete, or there is a missing link in the chain of observations. The arrows, when charted, fly with the wind and exhibit the direction and force of the wind, in a way to facilitate the study.

In entering the large mass of facts reported, great care is necessary to chart them in their proper places, geographically. This is done by means of an index-map, on which the names of all the reporting stations are entered with a number of its own attached to each station. By glancing at the corresponding number on the International Chart, the cartographer sees at once where each station's report is to be inserted, the number on the chart serving in lieu of the name of the station. By employing this expedient, while the utmost accuracy is attained, and every observation gets into its correct geographical place on the chart, the latter is freed from the crowding and blurring which would be unavoidable if all the names of stations were printed on its face; the risk of misplacing the data on the chart is lessened, and the draught when completed gives greater clearness and relief to the phenomena themselves.

An incidental, but by no means insignificant advantage of the cartographer's work is that it serves as an effective *check* on the observations as entered in the Bulletin. For, if an error of an instrument's reading has been bulletined, when it comes to be entered at its proper place on the chart, the draughtsman's eye is arrested by its incompatibility with the associate readings, and he must needs ascertain the correction before he can proceed with his plot. Thus, indirectly, the charting of the data furnishes a test and a corrective of the Bulletin, and also, if necessary, of the original reports as forwarded by the observers.

These items of the work may seem to be small matters of transient moment. But they are far more. It is by steps, cut, one by one, in the crumbling rock, that the traveler, emerging from the over-shadowed valley and seeking to scale the declivities towering above him, must often make his upward way. So must it be with the meteorologist essaying to gain higher view-points in nature. To him, therefore, every such simultaneous or synoptic chart offers another foothold for ascending to a higher plateau of research, whereon, in a clearer and more luminous sky, he may command an immensely enlarged horizon, and intelligently, mutely, survey the magnificent and mighty mechanism of the atmosphere. The Astronomer Royal, of England, when testifying, last year, before a government committee at London, said, "that, before meteorology could be developed as a science proper, there must be more numerous observations, from more numerous stations throughout the world, by means of which to construct daily weather-maps." This deliverance but echoes the concurrent testimony of many meteorologists; but, long before its authoritative utterance on the occasion mentioned, the plan it suggests was in process of practical execution by the Army Signal Office at Washington, from which the actual issue of daily International Weather Maps commenced on July 1st, 1878. Of course, the daily International Weather Map is the first-fruit —the efflorescence—of the whole body of simultaneous international observations; and must depend, for its maintenance and improvement, upon the development of the latter. But, if the observers now in the field be encouraged and their number multiplied, and judiciously located, so that the materials for the construction of the chart are abundant, we may venture to anticipate, it is destined soon

to prove the most fertile agent of meteorological discovery—the most knowing, trusty and communicative guide into the misty domain of atmospherical phenomena —whose aid has ever been invoked by the investigator.

"In vain," says Prof. Hughes, "would the ingenuity of man be excited in determining the form and magnitude of the earth, and the positions occupied by different places upon it, if he were unable to adopt some method of making these observations *apparent to the senses.*" The remark applies in any study of the atmosphere with as much point as in geographic pursuits. The maps of Columbus were, doubtless, to his mind, indispensable and invaluable auxiliaries in maturing the reflections which utimately led him to embark on his voyage to the new world, as they were his guides on the way. No less valuable will the meteorological charts be for all future exploration of the aërial world, whose forms are less palpable and distinct than those of the globe which it envelopes, and, hence, have more to gain by being *pictured.* "If the making intelligible and bringing into subjection of the varied, unwieldy and almost unmanageable mass of materials by the simple employment of the element of form, be," as Carl Ritter said twenty years ago, "the great improvement in the science of geography," we may infer what the modern weather-chart is capable of achieving for meteorology. The terrestrial chart can only represent the earth in repose. But the series of daily, colored, synoptic charts puts the atmosphere before the eye in *pictured action.*

The preparation and printing of these for use at the Signal Office began on October 1st, 1877; but, their *daily publication,* as we have said, dates from July 1st, 1878. The series issued is unbroken, from this last-named date, and will be regularly continued, and forwarded to all offices and observers on land and at sea coöperating with the Washington Bureau. The study of the Earth's meteorology thus made easy, opening the attractive and awe-inspiring volume of nature—radiant reflection of its Creator, and rich in types of His invisible things—must, when once made known, possess a charm for many besides the scientist and the seaman, and hold every right mind in delighted contemplation.

We have already, in a measure, anticipated and answered the question of the *utility* of this vast system of International Meteorology. But, doubtless, there are not a few, who, though viewing it with no hostile spirit and who are ready to accord to scientific research generally, its real and full worth, inquire, What are the substantial advantages this system can promise? Such an inquiry is not impertinent, but is entitled to receive a specific answer, if the friend of the system can render one. For blind, aimless research is no research at all. While, then, it is not our object to vindicate or to disparage the system, we may briefly indicate some of the utilities which, in our judgment, lie within its reach.

Apologetically, we may premise, that, at the least, the fact that so large a corps of observers, numbering so many of the ablest scientists of the day, and so many practical seamen, both naval and mercantile, are lending their thought, time and toil for the work, affords strong presumptive and *prima facie* evidence

of the utility and extensive practical advantages that may be realized by the vigorous prosecution of international meteorology. It is hard to believe that such a force of shrewd coöperators would invest their talents and industry in this enterprise, had they no assurances of substantial returns, and did they not know it to be far from a Utopian waste of their pains. Not a few of those actively engaged in furthering these researches belong to a class incredulous of new things and slow to take hold of anything wearing the aspect of inulitity.

Although this system, as now prosecuted, is novel, there are not wanting some precedents, which afford us the means of estimating its probable value and of ascertaining the results that may reasonably be expected to accrue from its maturer and unique method. Let us glance at one of these precedents. In 1853, in accordance with a plan of concerted research, arranged at the Brussels "*Maritime Conference*," the United States collected and utilized an immense mass of marine observations, and, through the labors of its "National Observatory," prepared and published the results deduced from them. The "Wind and Current Charts," and the "Sailing Directions," of Lieut. Maury, based on the data then collected, were and are to-day esteemed, by maritime men, of incalculable value to navigation and commerce. By the use of the deductions, (which, but for this work, had ever remained impossible,) invaluable light was shed on the dark points of the ocean physics and meteorology, and some of its gravest problems received an early and easy solution. Tentative and defective as was the system proposed at Brussels, and confessedly inadequate as were the materials within reach of its executors, the remunerative yield of practical benefits exceeded the most sanguine expectations of its friends. By the application of its results to the mariner's perilous work, the safety of his vessel was greatly increased; new and more propitious paths across the trackless waters were discovered, and the tedium and expense of long voyages greatly diminished. The voyage for sailing-vessels from England to Australia and back was, thereby, shortened, according to nautical authorities, not less than two or three months; and the average time of such vessels from New York to San Francisco was soon reduced from 180 to 100 days—a saving of over 40 per cent. of the time formerly consumed at sea and, consequently, a very material lessening of the costs and perils of the voyage.

The system set on foot at Brussels in 1853, was not a system of international meteorology; but, more strictly speaking, of *ocean-research*. It was, as we have intimated, tentative and provisional, designed to feel the way into the unexplored phenomena of the sea, and to elucidate its physical geography and meteorology. It made no arrangement for the collection and discussion of observations extending over the land surfaces of the earth; it made no serious attempt to investigate the atmosphere of the globe as a unit; nor did it institute simultaneous meteorological observations. And, whatever concert of the nations it at first had, its systematic prosecution as an international work had been suspended long before the assembling of the Meteorological Congress at Vienna, in 1873. But, if with all its drawbacks, its scanty materials, and observations unavailable for rigid inter-com-

parison, the old system of ocean-research could achieve so many useful results, and in so short a life-time, how much more may be justly expected and shortly realized from the new and far more comprehensive system of international research? The latter, as now worked, gathers to itself, at least for the northern hemisphere, richer and more reliable materials, out of which to construct and elaborate even the meteorology of the ocean, than ever the former system could command; while it also enters well-equipped, a field of vast expanse, into which the maritime Brussels' Conference, in 1853, could but wistfully, though hopelessly look. The two systems of research, though possessing some common characteristics, differ widely in their aim, scope, machinery and method of procedure. But, if the earlier system be taken as a precedent, by which to prognose the future of the later and larger system, we must admit that the latter is capable of furnishing incomparably better results. But, to come to the more specific statement of the benefits that are likely to be obtained from the accumulation and publication of the data in the International Bulletin and Chart. One practical application, to which they may soon be put by competent meteorologists, is the elucidation of the long-agitated questions of the *oceanic storm-tracks*—particularly the *Trans-Atlantic tracks of American storms*, after leaving our coasts and moving toward the British Islands, and the determination of *how far the approach of these cyclones toward the British coast can be predicted by the American storm-warner.* This is a problem affecting every interest of the inter-commerce of Europe and America: Do storms of a given type, in certain months, when confronting areas of high and low pressure of certain gradients, make their trans-Atlantic paths from the eastern coasts of the United States toward Iceland, or toward England; or, do they take a more easterly course toward France, or, further, do they recurve with the North Atlantic drift-current southwardly, around the Azores?

It is confidently asserted, that a number of predictions of the probable arrival of American storms on the British coasts have been successfully made from this side of the Atlantic, by amateur enterprise. Without now attempting to analyze these private predictions, or passing judgment on their merits, we may safely affirm, that, if one-half of their reported successes can be substantiated, the fact would argue immense practical advantages to be, in future, derived from the more scientific and systematic use of the International observations and charts. The amateur work referred to must, necessarily, be done with very inadequate facilities and in the absence of much light derivable from the International Charts. when these are subjected hereafter to the rigid analysis and discussion of the most expert and sagacious meteorologists. If, thereby, in the proximate future even two or three of the great Atlantic storms that ravage the sail-whitened offings of the British coasts can, every year, be foretracked and their destination be telegraphically and officially announced to the threatened European districts, the life-saving and property-saving thus effected would amply compensate for all the labor and expense of the international system, to which such timely storm-warnings would owe their success. Amateur essays, in this direction, however defective in

their methods and uncertain in their conclusions, may nevertheless, show what *can* be done, when the simultaneous observations and charts now accumulating at Washington shall have been subjected to the the maturer study and discussion of trained investigators well-versed in both the practical and scientific processes of official weather-prediction and weather-research. But, whatever may be the verdict as to the proved results of the present private endeavors to pre-announce trans-Atlantic storms impinging on the British coasts, there are manifest and cogent reasons for assuming that the development of the public international system which we have been describing, will ultimately enable skillful meteorologists to give timely warnings of some of the great cyclones, which, first felt on this side of the Atlantic, rapidly extend their widening circles of disturbance eastward across its unresisting bosom, and finally, unsuspected, pour out their long-accumulating fury where the world's ships and navies most congregate, on the eastern shores and islands. The difficulty of hereafter making such premonitory announcements may not be so great as it now appears. The North Atlantic basin is long, *trough-shaped* and comparatively *narrow*, its shores converging toward Iceland; so that the liquid plain, over which the cyclones to be pre-announced must move, affords them but comparatively little room for very eccentric and wide deviations, and thus, in their northeastwardly advance, they can hardly fail to make their dangerous marginal winds felt in the shoaly and land-locked waters of Great Britain. The force of this last remark will be made more apparent if we consider the diameters of the great cyclonic disturbances in question; which, according to Buchan, average 1,200 miles. If we locate the center of such an immense meteor in the narrow Atlantic, midway between Newfoundland and France, and give it the eastwardly motion which the Atlantic hurricanes usually have, it is difficult to see how it can pass to the north or south of the British Islands without ultimately creating disturbances, premonition of which would very materially benefit the shipping around these Islands. The day will never arrive, perhaps, when even premonitions* of approaching cyclones cabled from the United States to England may not sometimes fail or miss fulfillment. But, with the enlargement of the "Marine Series" of simultaneous observations, the development of the Interna-

* Possibly *premonitions*, (not predictions) of trans-Atlantic storms may be the most that will ever be accomplished. But these would be far from valueless. A recent investigator has examined seventy-seven storms near the coast of the United States, only twenty-eight of which, was he able to trace, with considerable confidence entirely across the Atlantic to the European coast. But, considering his fragmentary data, no deduction can be made from them, conclusively, or that would not be premature. Two things, we conceive, are necessary to enable an American meteorologist to send reliable warnings to Great Britain. I. He must have some reports of the storm from steamers or vessels arriving at the northern or eastern ports of the United States, within a brief time after their encountering it; so as to obtain some idea of its *altered* course and intensity after it got fairly on the sea. The tendency of cyclones after leaving the United States is to increase in intensity on reaching the "Gulf Stream "drift-current; and one or two barometer readings giving the bearings of the storm-centre, when yet only a few hundred miles from these coasts would go far toward determining its final track. II. He must have some cablegrams from the other side, sufficient to give him the general conditions of pressure prevailing over western Europe, two or three days before he expects the storm to reach it. The necessity of these will be noted presently (see above). Can these two conditions be measurably complied with? We can see no reason why they may not. With reports from incoming steamers, telegraphed from Sandy Hook, Boston, etc., and a brief cipher cablegram from England, giving general data, chief obstacles to sending *premonitions* of the storm would be measurably removed.

tional Charts, and the study and discussion of the masses of data now being collated at the office of the Chief Signal Officer, we may not unreasonably expect that occasional premonitions or "indications" of selected storms can with considerable confidence be telegraphed from Washington to London, and prove most valuable to Great Britain and Northern Europe. These considerations may suffice to show all British and European merchants and seamen how deeply their interests are involved in the prosecution of this system of international meteorology, and how important it is that all steamship captains and other shipmasters should undertake the interesting task of making the simultaneous observations and forwarding them to the Chief Signal Officer at Washington. Every such co-operator, besides rendering valuable aid to his own craft, and increasing his skill as a navigator, will receive in return a printed copy of the International Bulletins, with the beautiful International Charts for every day in the year.

Not less important to European meteorologists, charged with the official duty of making timely forecasts and issuing storm warnings for their respective countries, will the International Bulletins and Charts now prepared at Washington necessarily prove. "About half the storms of middle and northern Europe travel from southwest or west-southwest toward northeast or east-northeast; and nineteen out of every twenty, at least, travel toward some point in the quadrant of the compass from the northeast to the southeast." This estimate of Mr. Buchan, an experienced British meteorologist, is, substantially, confirmed by all.

And Mr. Scott, the Secretary of the Meteorological Council, London, in his recent book, "Weather Charts and Storm Warnings," apologizes for the very partial success of the official storm predictions made in London, by referring his reader to the present impossibility of obtaining weather reports from the region lying to the westward of Great Britain. He tells us he cannot hope for very great success in predicting British gales unless he could anchor a floating station, 600 miles west of England, in 1,000 fathoms of water, reporting automatically by cable to the central office at London; and he very justly concludes that the problem of fixing and maintaining such an observatory is not very near its solution. The helplessness of weather telegraphy and storm warning in England, by reason of the geographical relation it sustains to the great Atlantic storm movements, is so great that the call has been made for a cable to the Azores, or to Iceland. "With daily telegrams from the Azores and Iceland," says a Scottish meteorologist, "two, and often three days' intimation of every storm which visits Great Britain could be had."

But such relief is, in all probability, very remote. In the meantime, the light which may be derived, by British and continental meteorologists generally, from the study and discussion of the International Weather Maps published by the United States Army Signal Office, ought to enable them to very materially increase the confidence and accuracy of their storm warnings. For some years to come, at least, these charts appear to offer the best material, and, perhaps, the only new resource for European meteorologists with which to improve their pre-

dictions of the great cyclones which invade their continent and its outlying islands from the Atlantic, annually strewing their coasts with the bones of so many gallant ships and the ruin of so many valuable cargoes. Certainly, the immense stores of observations elucidatory of Atlantic meteorology and its connection with European meteorology, now collated at Washington and reduced (in the International Charts thence issued) to graphic and didactic forms, which speak more than volumes of figures, and are easily studied, hold out a promise of a great boon to all European official co-operators, and, eventually, to the interests they represent.

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While we would unsparingly reprobate the resort to any species of that boastful and man-defying gratulation of scientific achievement, replete with vaticinations born of ignorance and living on baseless assertions, that have done more than aught else to disgust the thinking, and to frighten the sober from the legitimate investigation of nature, we may, nevertheless, refer to such an indorsement of the system which we have been reviewing, emanating, as this indorsement does, from a foreign and rival source.

The Chief Signal Officer, in one of his official reports, expresses the hope that, "by systems of observation thus extensive, generalizations may be had to permit the announcement of approaching meteoric changes for periods longer in advance than have hitherto been practicable." How far this hope may be realized, remains to be seen. But the development of the international service over the West Indies, the inter-tropical parts of South America, and Mexico, ought surely to facilitate the knowledge, and thus the prevision, of those destructive hurricanes that, gendered in the warm bosom of the equatorial ocean, emerge thence and furiously assail our Gulf-bordering and Southern States.

A better knowledge of the Pacific Ocean storm tracks, and their recurvation upon the western shores of North America, may justly, we think, be looked for from the study of the marine reports now furnished by the Pacific Mail steamship captains, and other co-operators. A long-felt want of weather-warning in the United States is greater provision for the Pacific and Gulf coasts, which can only be supplied as increased light is shed on the meteorology of the regions lying, respectively, far to the westward and southward of these exposed borders.

As this system of weather research is developed, and its charted data placed under the analytical study of scrupulous and experienced meteorologists, it can hardly fail to admit, incidentally, of useful application to hygienic and sanitary problems, into which meteorological elements enter sometimes as important factors. That its maturer deductions will not be valueless to the climatologist, it may reasonably be expected. But on these points it is unnecessary to dwell. Enough has been said to establish its utility in the domain proper of meteorological investigation; and this may well content those who are laboring to further it.

"Meteorology," to borrow the words of Mr. Buchan, "is eminently the science of observation and averages, and, before those inquiries now raised regarding the general movements of the atmosphere can be satisfactorily and adequately discussed, it is indispensable that the field of observation be extended, so as to embrace nearly the whole of the Northern Hemisphere"—words which, though long since written, have not been fruitless in more recent years. As they suggest, we may now add that the great desiderata of the International Weather Service at present are more extensive and earnest co-operation by those who are capable of making simultaneous reports, especially steamship and ship captains of all nations, and observers in quarters where there are gaps to be filled up, and, lastly, the discussion of the charts and the publication of the generalizations drawn from them. Perhaps we cannot better close this retrospect of a work of such magnitude, than

in the words of an eminent German surgeon, when reviewing the results of a novel and most difficult operation in conservative surgery: "The prospect of success it offers is such as to make the operator both *bold and modest.*"

TECHNOLOGY.

THE RELATION OF ÆSTHETICS TO INDUSTRY.*

BY V. W. CODDINGTON.

(*Concluded.*)

Among the abstruse elements of excellence are:

1st—Economy. Not economy of labor, but economy of material. A superabundance of material for a given purpose is just as undesirable as not enough. Nature in her methods of construction is always careful to use no more material than is necessary to accomplish her purpose, and the artisan who has not the skill to manipulate a minimum amount of material for a given purpose betrays an unmasterly hand.

2d—Honesty. Our better natures repudiate falsehood wherever we find it. No less should it be repudiated in art industry than anywhere else.; yet nowhere else has it been more prevalent. To all kinds of expedients resort has been made to gain effect—in furniture drawer-fronts that have no drawers behind them; doors that open nowhere, or, perhaps, do not open at all; handles that have no use; wood that professes to be one thing and is really another. The most illiterate and unskillful falsehood that I ever saw in furniture may be seen in a bureau which I have in my possession. It is veneered with mahogany, and the grain of the veneering runs up and down, or crosswise of the drawer, the drawer being about eight inches wide and three feet long. No sane cabinetmaker would ever think of cutting out a solid drawer-front in that manner; it would probably break before he got it together. And yet that bureau has been standing twenty-five or thirty years, persistently contradicting one's idea of good construction. In the construction of our houses we are likely to find the same pernicious falsehoods—brackets that support nothing; columns and pilasters that have no weight above them, or, the converse, absence of a column or pilaster where there ought to be one; windows that light nothing, or, as I have seen them in Kansas City, allowing the sun to shine through them from the street to light up the roof behind them. These are a few of the falsehoods perpetrated in industrial art.

3d—Color. Color, as applied in the industries, is natural and artificial. Natural color is the color of the material, such as walnut, pine, stone, brass, and

* Read before the Kansas City Academy of Science, January 27th, 1880.

gold. Artificial colors are obtained by the use of pigments. The civilization of to-day is not an adept in the use of color. Scientists have studied it as a phenomenon of physics, and can demonstrate to an atom the proportion of colors necessary to complete harmony; but in practice the imperfections of pigments will baffle them.

The use of color seems to be an institution whose proper development has been dwarfed by the monopolizing character of other matters in the processes of civilization, and, if we would learn in this respect, we must sit at the feet of the barbarian in those countries where nature has so lavishly bestowed her hues for his education. The great difficulty in the way of our education in this respect lies in the unwillingness of the average civilized man to be taught by the barbarian. He imagines that general culture and advancement mean, necessarily, superiority in all things, and does not realize that in some respects the barbarian may be more civilized than he. Upon this point I quote from Lady Varney, in the *Contemporary Review:*

"The Hindu arranges colors for a fabric with the same certainties of intuition that a bird weaves its nest or a spider its web. His blues and greens are as harmonious in their combinations as those of nature herself while the educated Englishman is introducing every species of atrocity wherever he goes, ruining the beautiful native manufactures by instructions from his "superior" standpoint, forcing the workers to commit every blunder which he does himself at home, in order to adapt their fabrics to the abominable tastes of the middle classes of England. Even the missionaries, male and female, cannot hold their hands, but teach their children, in schools and harems, crochet and cross-stich of the worst designs and patterns, instead of the exquisite native embroideries of the past. Arsenic greens, magenta and gas-tar dies are introduced, by order of the merchant, into carpets and Cashmere shawls. Vile colors and forms in pottery, and bad lacquer-work, are growing up by command in China and Japan. There seems to be no check or stay to the irruption of bad taste which is swamping the whole world by our influence."

4th—Among the abstruse elements of excellence is Form, or Proportion. The form of any manufactured article is largely dependent upon its use and the nature of the materials at command. In practice it is oftentimes closely allied to economy of material. For example, the panel is more economical and more beautiful than the solid; the column is more economical and more beautiful than the pier.

But there are, aside from the matter of economy, certain laws of proportion which define to us the conditions of good proportion. For instance, the proportion of two to five is better than that of two to four; of three to eight, better than that of three to six, or three to nine. In other words, a subtle proportion is better than one that is easily apprehended. But, in industrial art, where proportions must of necessity be within certain limits, it must be left almost entirely to the artisan to produce the best results obtainable within those limits. Consequently, an intuition for proportion is more important than a knowledge of the law, and we

must cultivate this intuition in the same manner that we would cultivate intuition for color, by a close observance of nature and the precept of a good example.

We have now counted some of the requisites of the abstruse elements of excellence. There are others, but it is not necessary to consider them here. We may sum them all as follows: Good art in any product of industry is the evidence of intellectual sagacity and genuine æsthetic feeling upon the part of the artisan.

I quote again from a casual writer in the *American Architect:*

"Artistic decoration is supposed to have a two-fold duty to perform: first, to decorate, and then, to tell a story, the first is to give richness in effect to the structure, space or fabric, which would otherwise be simple, plain or crude. Plastic decoration (color decoration too) becomes an art only when it becomes expressive of an idea, when it is crystallized thought, when you can read it like a book, whether it represents animate or inanimate nature. A large building decorated artistically will give indefinite pleasure to a cultivated mind. The more one looks at it the more one finds in it to admire. One cannot take it all in at once, while a building decorated until one cannot rest with gold and ornaments, containing no idea, receives but one glance, is called 'magnificent,' and let go. One glance is enough. Whenever you look at it again your mind says at once: 'Oh! I've seen that before.'"

In each succeeding instance, very nearly the same identical conditions were to be filled and the same means of filling them were at hand. So the architect, instead of branching out into new fields of investigation, new methods of construction, was content to put his columns and pilasters just where his ancestors put them, seeking only to enhance their beauty and give, by one method and another, added grace to the form of the structure, touching up the leaf of a capital here, deepening the shade of a molding there, little by little, and with conscientious care, seeking to make more valuable the legacy which his fathers left him.

Thus was perfected that purity and beauty of style which has been the model and the marvel of ages. The best results of Roman architecture were attained by the same slow methods. But, after a while, Greece and Rome lost their prestige, the world banished the old mythologies, and the Christian religion became paramount. New structures for new purposes became necessary, and they were to be erected in other countries, by the use of other materials and other methods, and under different conditions of society. And so arose Gothic architecture and Gothic art.

But the first changes from the old forms and methods were faint and imbecile, marking the efforts of a people trying to accomplish something, not understanding clearly what.

Groping blindly after the light and slowly finding it; stepping boldly to an experiment in this direction, and timidly projecting one in another; retaining the successful, rejecting the unsuccessful; slowly casting aside the cumbersome and useless features of the old, slowly adding on the new. No one man

invented the style; it was the work of a multitude. Each architect held in his hand as it were the experience of his predecessors, and adjusted them to meet the requirements of the problem at hand; raising an arch a little here, clustering columns together there, meeting the thrust of that vault with a buttress, gradually massing the walls into piers, filling the spaces between with windows, after a while grouping these windows, changing them to suit the different requirements of light, of construction and of beauty, and thus passing on from one step to another until the highest excellence was reached.

Thus were developed the Grecian and Gothic styles of architecture and contemporary with and in harmony with them the entire train of industrial arts. Growing as grows the tree from the seed, at first feeble and uncouth pulling its way out of the ground, and gradually, year after year, unfolding its excellencies to the sunlight, and at last in the fullness of life giving out the blossom and the fruit. The blossom and the fruit exhibiting withal an individuality in harmony with and partaking of the nature of the first shoot that came from the ground.

Not only did Grecian and Gothic art attain their excellencies by the above processes, but no worthy manifestation of industrial art ever existed that was not produced in similar manner.

Now to bring the application of these remarks down to our own time and our own country, we want to know wherein this question is one of concern to us as a nation and as a community. Properly understood, the value of art work to to any country—especially as applied to the industries—can not be questioned. The part which it plays in the political economy of a nation is an important one. It is a historical fact throughout all time that those peoples who have exhibited the greatest advancement in industrial art have been able to command the markets of the world. It has been theirs to choose, and it has fallen upon their neighbors to pay for the choosing.

To-day the staples of our markets are wheat and beef, and it is true that wheat and beef are splendid things to have for sale where the world is hungry. People will eat and he who has food to sell rarely fails to find a market for his commodity. But when the world is fed it has no use for bread and meat, and the country that depends solely upon the sale of these things for a livelihood is subject to the caprice of the markets. To-day they may sell at a profit of 100 per cent, to-morrow at a loss of 50 per cent. But the people that is skilled in the industries, that moreover can send its products abroad stamped with a name which the consumer knows to be synonymous with excellence in *all* of its attributes has in its hands the source of wealth unbounded.

We all know how France has for so many years held the prestige of the world in this respect; how French goods have found ready sale and high prices in every market, and we have seen with that wonderful elasticity the French people arose from the disasters of a great war. How easily they paid off that immense indemnity, and all because the French people have right in their hands the true sources of wealth. They have not in their work discarded any elements of

excellence. They have realized and felt that the world demands and will pay for those impalpable attributes which satisfy longings of an æsthetic nature.

The wealth flowing into the coffers of this people has been one of the objective results of this policy. The subjective results are no less marked. They have settled from the top to the bottom of society, permeating every industry, even to the tilling of the ground. No country is better tilled than France, raises more food to the acre or food of such excellent quality. So of the other industries. The man who grows up in an atmosphere which favors the growth of all excellence for mere excellence' sake, you may be sure that whatever vocation he may adopt he will be in it an adept so far as in him lies.

To this is due whatever of mental and material prosperity France enjoys to-day. It has made her prosperous in spite of her frailties, which we know are grievous. There is but one thing lacking in French art, and that is moral stamina. How this affects art industry I hope at some future time to discuss. So much at present with France.

America stands, it seems to me, pre-eminently fitted to take up this work of art industry and carry it through to the highest consummation. She has, as a foundation, a peculiarly rich development in mechanical science. She is enough removed from the old world to be untrammeled by its traditions, yet near enough to study and assimilate the experience of the ages. We have with us, I think, enough native art feeling to work out a style avowedly American, yet no less worthy than those great styles which have given tone to all the art work of Europe. And the work has already begun. A style, an offshoot of Gothic art has taken root amongst us. Its examples, many of them crude and unskillful, are to be found in houses and furniture in various parts of the land.

The best instances are found in the older and wealthier cities. They mark the beginning of a new era in American industry. Beginning, I say, and not the ending, for the end is a long way off. Rapid advancement, it is true, has been been made in the past ten years but not all of it has been true advancement. It is a struggle all the way through ignorance and fallacy upon one hand, intelligence and truth upon the other. There are besetting sins into which votaries of art have at all times been liable to fall and the American disciples are no exception to the rule. Real progress is arduous. There is the old adage, "No excellence without great labor." It is just as true in the province of art as anywhere. The process brings to mind the words of the poet Boker:

> "Silently sat the artist alone,
> Carving a Christ from the ivory bone,
> Little by little with toil and with pain;
> He won his way through the sightless grain,
> That held and yet hid the thing he sought."

True art growth is not the caprice of fashion. It is the thought, life and feelings of a people wrought into its industries. It is the evidence of an attempt upon the part of a people to bring out from the inanimate forms of wood and stone, of brass and iron, expressed aspiration for nobler and better things.

So what our art shall be, it is for us as a people to decide, whether it shall be trivial, commonplace and meaningless, or earnest, living and progressive. If what we have done in other lines of thought and investigation is an earnest of what we are to do in this, a good result is assured.

Here in the west we, perhaps, have some difficulties to encounter which are not found farther east, the most notable being, the engrossing character of the rapid development of commerce and the natural resources of the country. It has been said that new countries are not favorable to the growth of art. "Society is too crude and uncultured to properly appreciate it." We don't plead guilty unconditionally to this charge, and I imagine that if we would only avail ourselves of the means of education at our command, encourage the good and depreciate the bad, from whatever source they came, the result would be a proper appreciation of excellence from its æsthetic and utilitarian aspects, productive of much good to our commonwealth.

GEOLOGY.

SOME OBJECTIONS TO MODERN GEOLOGICAL TEACHINGS.

BY J. A. SMITH, PAOLA, KANSAS.

There are some things, in the accepted history of the earth's crust, that do not, in our opinion, agree with the first chapter of Genesis. Our purpose is not to assail the Bible; on the contrary, we hold that any statements or theories which do not harmonize with the general teachings of the Bible, are false. What we particularly object to is the construction put upon the word "day" in our text-books and standard works on geology. And we wish these objections to be regarded rather as inquiries after truth, than attacks upon any of the established principles of the day.

To begin at once, we quote from Dana's Manual, page 768: "Objections are often made to the word 'day'—as if its use limited the time of each of the six periods to a day of twenty-four hours. But, in the course of the document (Scriptures) this word day has various significations, and, among them, all that are common to it in ordinary language. * * * * * The proper meaning of 'evening and morning,' in a history of creation, is *beginning and completion;* and, in this sense, darkness before light is but a common metaphor.

"A Deity working in creation, like a day-laborer, by earth-days of twenty-four hours, resting at night, is a belittling conception, and one probably never in the mind of the sacred penman. In the plan of an infinite God, centuries are required for the maturing of some of the plants with which the earth is adorned"

On page 769 the same author says: "Each of these eras opens with the ap-

pearance of *light;* the *first*, light cosmical; the second, light from the sun, for the special uses of the earth.

We believe these principles are generally accepted among geologists.

The first objection is based on the well-known physical law that vegetation cannot germinate, grow, mature and reproduce its kind without the influence of sun-light. But according to Genesis, vegetable life made its appearance on the third day, and the sun on the fourth. If these days were periods of years, as the geologist claims, he must admit one of two things—that the sun lighted the earth at this time, or that vegetation grew in darkness. The latter position is unphilosophical; and if he takes the former he has no reason for assuming that the light spoken of in the third, fourth and fifth verses of the first chapter of Genesis is cosmical. These verses read:

"And God said, Let there be light: and there was light.

"And God saw the light, that it was good: and God divided the light from the darkness.

"And God called the light day, and the darkness he called night: and the evening and the morning were the first day."

Mark the language in the last verse. The *light* he called *day*, and the *darkness* he called *night*. This cannot mean anything but a literal day. And in the the following sentence, "the evening and the morning were the first day," the connection with the preceding thought is so close that it would be a far-fetched translation that would make the word "day" in one differ from the same word in the other. Again, in the fourteenth verse we have recorded:

"And God said, Let there be lights in the firmament of the Heaven, to divide the day from the night; and let them be for signs, and for seasons, and for days, and for years."

The conviction is irresistible, that these days divided from the darkness, or nights, by the solar light, are days of twenty-four hours. And to take the same word in the original and so contort its meaning as to make it agree with the geological theory of creation seems a little unsatisfactory.

"But," somebody is ready to say, "you are illogical in your reasoning. How can you regard the day mentioned in the fifth verse as being literal, and at the same time grant that the sun did not divide the day from the night until a later period, as mentioned in the 14th verse?" We grant no such a premise. That the sun had been in existence ages prior to this time, the merest tyro in science will hardly deny. And there is not the shadow of proof to show that the *light*, which was called *day* in the fifth verse, and the *day* of the 14th verse were anything more than *literal days*, as used in ordinary language. If the sun did not shine before the fourth day, then, of course, this argument falls to the ground.

In Exodus xx–8, is the command, "Remember the Sabbath-day to keep it holy," and in the 11th verse, "For in six days the Lord made Heaven and Earth, the sea and all that in them is, and rested the seventh day, wherefore the Lord blessed the Sabbath-day, and hallowed it." In this we are commanded to rest on

the seventh day; and our attention is called to the example of the Master who rested from the labor of the six day's creation. But if He labored six periods of years, and rested on the seventh period, we are perfectly justified in doing likewise.

Another objection presents itself, which will be better understood by first quoting from Dana, page 384: "At the close of each *period* of the Paleozoic ages, there was an extermination of a large number of living species. Again, as each *epoch* terminated, there was an extermination of life, but in most cases less general. With the transitions between strata of different kinds in the course of an epoch, there were usually some exterminations; and, even in the passage from layer to layer, there is often evidence of the extinction of some species. In a corresponding manner, there were often one or more new species with each new kind of layer, and generally several with each change in strata; while many appeared with the opening of an epoch, and a whole fauna, nearly, with the commencement of a period. Hence, the introduction and extinction of species were going on through the whole course of the history, instead of being confined to particular points of time; but at the close of long periods and epochs, there were more general exterminations."

On pages 487–8, the same author says: "No species of the European Cretaceous is known to occur in the Tertiary formation, and none of Asia or Eastern North America. In the Rocky Mountain region some Cretaceous species and genera continue on, if the coal series is Tertiary; and yet the number now known is less than half a dozen. The vast majority of the species, and nearly all the characteristic genera, disappear." In brief, Prof. Dana lays down the principle that at the close of each period there was almost universal extinction, followed in the next period by a new creation. This would lead to the following results:

1. A disappearance of early life.

2. A creation of fauna and flora now on the globe, of which geology affords no record.

Considering these facts, we are driven to the conclusion that the Mosaic account refers exclusively to the creation of 6,000 years ago. It cannot refer to two at the same time, since only one is mentioned. Or, if it does not refer to the creation of 6,000 years ago, it *must* refer to that of geology, and therefore we have no account of the manner or time in which present life came into existence.

Again, the record of the six days' work in Genesis, denotes *completion*. The 21st verse, for example, reads, "And God created great whales and every living creature that moveth, which the waters brought forth abundantly after their kind and every winged fowl after his kind." This was the fifth day. The verb will admit of no idea of continuance or progression. Life of the ocean and air was the result of one day's labor, and with that day the work ended. On the sixth day "God made the beast of the earth after his kind, and cattle after their kind, and everything that creepeth upon the earth after his kind."

It is a well-known fact that there are mammals now living on the globe, of

which geology has no knowledge; they appeared ages after the first protozoans began their movements in the sea; and even geologists themselves will hesitate before including the Silurian and Tertiary ages in one day of creation.

"In the beginning God created the heaven and the earth." This also implies completion, and it is the first announcement made in the divine record. After it came the creation of those things which dwell upon the earth, and move in the sea and in the air. It does not say that life came while the earth was building; to the contrary, the declaration that God created the heaven and the earth is a distinct, a clear and a definite statement, unmodified by anything that follows. It is not in our province to substitute a better theory in place of the one we are discussing. But if the first chapter of Genesis can be interpreted literally, leaving the geological work of creation to precede the six day's work of the Creator, or to be included in the labor of the first day, we think that the Bible and geology will harmonize more fully than they do at the present time.

THE ATTRACTIONS OF THE YELLOWSTONE NATIONAL PARK.

The Yellowstone Park embraces an area of fiftv-five by sixty-five miles, and contains the most striking of all the mountains, gorges, falls, rivers and lakes in the whole Yellowstone region. The hot springs on Gardiner's River, for example, are along its northern boundary; the Grand Cañon lies toward its northeastern corner; toward its southeastern corner stretches Yellowstone Lake, and occupying the western central portion is the wonderful Geyserland.

"This whole region," says Dr. Hayden, the United States geologist, "was, in comparatively modern geological times, the scene of the most wonderful volcanic activity of any portion of our country. The hot springs and geysers represent the last stages—the vents or escape pipes—of these remarkable volcanic manifestations of the internal forces. All these springs are adorned with decorations more beautiful than human art ever conceived, and which have required thousands of years for the cunning hand of Nature to form."

Entering the Park by the Virginia City wagon road, the visitor first encounters the geysers. These rival the most famous of Iceland, and deserve detailed description. The explorer—Lieutenant Barlow—tells us that near the edge of the basin, where the river makes a sharp bend to the southeast, is found the initial geyser—a small stream vent—on the right. Soon on either side of the river are seen two lively geysers called the "Sentinels," because of their nearness to the gate of the great geyser basins. The one on the left is in constant agitation, the waters revolving horizontally with great violence, and occasionally spouting upward to the height of 20 feet, the lateral direction being 50 feet. Enormous masses of steam are ejected. The crater of this is 3 feet by 10. The opposite sentinel is not so constantly active, and is smaller. About 250 yards from the gate are three geysers acting in concert. When in full action the display from these is very fine. The waters spread out in the shape of a fan, in consequence of which they have

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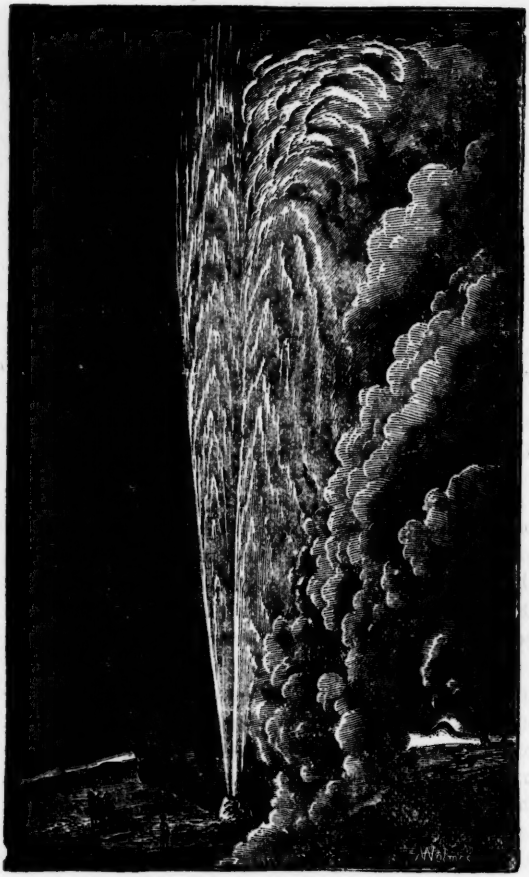

FAN GEYSER.

been named the Fan Geysers. One hundred yards farther up the side of the stream is found a double geyser, a stream from one of its orifices playing to the height of 80 or 90 feet, emitting large volumes of steam. From the formation of its crater it was named the Well Geyser.

Still above are found some of the most interesting and beautiful geysers of the whole basin. First are two smaller geysers near a large spring of blue water, while a few yards beyond are seen the walls and arches of the Grotto. This is an exceedingly intricate formation 8 feet in height and 90 in circumference. It is by many called the gem of all the geysers. It is absolutely magnificent —a sight of resplendent beauty that greets the eyes nowhere outside of the region of the National Park. It is simply a miniature temple of alabaster whiteness, with arches leading to some interior Holy of Holies, whose sacred places may never be profaned by eye or foot. The hard calcareous formation about it is smooth, and bright as a clean swept pavement. Several columns of purest white rise to a height of 8 or 10 feet, supporting a roof that covers the entire vent, forming fantastic arches and entrances out of which the water is ejected during an eruption 50 or 60 feet. The entire surface is composed of the most delicate bead work imaginable, white as the driven snow, massive but elaborately elegant, and so peerlessly beautiful that the hand of desecration has not been laid upon it, and it stands without flaw or break in all its primal beauty —a grotto of pearls, " the beautiful princess of all the realm."

Proceeding 150 yards farther, and passing two hot springs, a remarkable group of geysers is discovered. One of these has a huge crater five feet in diameter, shaped something like the base of a horn—one side broken down—the highest point being fifteen feet above the mound on which it stands. This proved to be a tremendous geyser, which has been called the Giant. It throws a column of water the size of the opening to the measured altitude of 130 feet, and continues the display for an hour and a half. The amount of water discharged is immense, almost equal in quantity to that in the river, the volume of which during the eruption is doubled. But one eruption of this geyser was observed. Another large crater close by has several orifices, and with ten small jets surrounding it, formed probably, one connecting system. The hill built up by this group covers an acre of ground, and is 30 feet in height.

Wonderful hot springs burst out at many different points in the Park, but those in the northern portion are most generally admired. The springs in active operation on Gardiner's River cover an area of about one square mile, and three or four square miles thereabouts are occupied by the remains of springs which have ceased to flow. Small streams flow down the sides of Snowy Mountain in channels lined with oxide of iron of the most delicate tints of red; others show exquisite shades of yellow, from a deep, bright sulphur to a dainty cream color; still others are stained with shades of green—all these colors as "brilliant as the brightest aniline dyes," declares one observer. The water, after rising from the spring basin flows down the sides of the declivity, step by step, from one reservoir to another, at each one of them losing a portion of its heat, until it becomes as cool as spring water. The natural basins into which these springs flow are from four to six feet in diameter, and from one to four feet in depth. The principal ones are located upon terraces midway up the sides of the mountain. "The largest living spring is near the outer margin of the main terrace. Its dimensions are 20 feet by 40 and its water so perfectly transparent that one can look down into the beautiful ultramarine depths to the very bottom of the basin. Its sides are ornamented with coral like forms of a great variety of shades, from a pure white to a bright cream yellow, while the blue sky reflected in the transparent water gives an azure tint to the whole which surpasses all art."

But the brightest jewel of our wonderful park—Yellowstone lake—must no longer pass unnoticed. It is about 20 miles long and 15 miles broad, with a rough and irregular, but almost enchanting shore line. Its superficial area is about 300 square miles, its greatest depth 300 feet, and its elevation above the sea 7,427 feet. Lying upon the very crown of the continent, Yellowstone Lake receives no tributaries of any considerable size, its clear, cold water coming solely from the snows that fall on the lofty mountain ranges that hem it in on every side. Of this the enthusiastic Langford says: "Secluded amid the loftiest peaks of the Rocky mountains, possessing strange peculiarities of form and beauty, this watery solitude is one of the most attractive objects in the world. Its southern shore, indented with long, narrow inlets, not unlike the frequent fiords of Iceland, bears

YELLOWSTONE LAKE.

testimony to the awful upheaval and tremendous force of the elements which resulted in its erection. The long pine-crowned promontories stretching into it from the base of the hills, lend new and charming features to an aquatic scene full of novelty and splendor. Islands of emerald hue dot its surface, and a margin of sparkling sand forms its setting. The winds, compressed in their passage through the mountain gorges, lash it into a sea as terrible as the fretted ocean, covering it with foam. But now it lay before us calm and unruffled, save as the gentle wavelets broke in murmurs along the shore. Water, one of the grandest elements of scenery, never seemed so beautiful before."

Besides its entrancing shore line the lake is dotted with numerous islands, which lend rare beauty by their luxuriant vegetation. Fish abound in the lake, game of all kinds inhabits the surrounding forests, and the placid surface of the water and grassy margins render this mountain-locked sheet the earthly paradise for myriads of water fowl. There are facilities for boating here, and rather primitive summer accommodations for the tourist.

It is but a pleasant two hours' ride from the lake to the falls. The head of Yellowstone Cañon is but a short distance above the Upper Falls, and just before reaching them narrows down to a close gorge, compressing the waters into so small a passage-way that they drive through with great commotion. The first fall is only a quarter to a half a mile above the lower one, and the stream dashes over a perpendicular cliff 140 feet high. "The river is now dashed into a turbulent, foamy cascade, by its ragged bed and lightning speed, and does not again become smooth until just the instant it takes its dizzying leap of *three hundred and ninety feet* perpendicularly to its narrow bed in the depths of the great cañon. On either side of the falls, and so far as the eye can see below, there rises to a height of two thousand feet above the river, a grand, vast wall of infinite masonry, so gorgeously colored and tinted, so bounteously beautified in gilt, purple and carmine, that no oil painting, however fine, will ever do justice to the natural picture! There is no painful glare of one color prominent over another; the Great Artist has used each brush deftly, and with his divinely exquisite touches each tint and shade is so perfectly blended that the mighty walls seem as if built by the equal commingling of all the precious metals of the world!"

The Great Falls of the Yellowstone, with their symmetrical proportions, containing "all the elements of picturesque beauty," and so intimately connected with all the strangely-fascinating enchantments of the delicately-carved and gorgeously-crowned Grand Cañon, excel in sublimity the world known Niagara, or the soul-inspiring Yosemite. As a friend, who is given to "cold figures" and poetry at the same time, says: "The height of Niagara Falls—164 feet—is 226 feet less than our beautiful falls of the National Park. The sheet at Niagara is 1,100 feet in breadth, while that of the Yellowstone is less than 200. The discordant roar of Niagara is liquid music at Yellowstone; the majesty of the former is poetry at the latter. The waters which dash over Niagara flow through a level and monotonous region, and have a weary, business-like appearance; while the

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Yellowstone, gliding through a region sublime in scenery and associations everywhere, falls into the grandest canyon of the world. The former are 300 feet above sea level, the latter 8,000! The great suspension bridge is but 258 feet above the water; a like bridge across this great cañon would rise *two thousand feet* above the little stream."

The view of the Grand Canyon from the heights above, is pronounced by a widely known traveler "The finest piece of scenery in the known world," and indeed it is hard to conceive of any combination of pictorial splendors which could unite so potently the two requisites of majesty and beauty. Twenty miles long it is impassable, and inaccessible at the water's edge, except at a few points. Its rugged edges are from two hundred to five hundred yards apart, and its depth is so profound that no sound ever reaches the ear from the bottom. "The stillness is horrible. Down, down, down, we see the river, attenuated to a thread, tossing its miniature waves, and dashing, with puny strength, against the massive walls which imprison it. All access to its margin is denied, and the dark gray rocks hold it in dismal shadow. Even the voice of its waters in their convulsive agony cannot be heard. Uncheered by plant or shrub, obstructed with massive boulders and by jutting points, it rushes madly on its solitary course. The solemn grandeur of the scene surpasses description. The sense of danger with which it impresses you is harrowing in the extreme."—*Resources of Montana.*

ENGINEERING.

OBJECTIONS TO DE LESSEP'S CANAL.

The countries interested commercially in establishing a water communication across the isthmus, are the United States and Great Britain. Neither of these countries believe that their commerce would be materially benefited by a canal across the isthmus at Panama. It was long ago stated by Com. Maury, the best authority on ocean winds and currents, that if by some convulsion of nature a navigable strait were opened there, it could never become a channel of commerce. It lies in the region of equatorial calms, and passage through it would be impracticable for sailing vessels. On the gulf side the northeastern trade winds blow directly against the coast, and a sailing vessel can not get away to the eastward. On the Pacific side the calm belt extends up to San Juan, and vessels leaving Panama are becalmed for weeks. If there were a passage through the isthmus, he said that sailing vessels would still save time by the much longer route around Cape Horn. This, he remarked, is the reason why so little use is made of the Panama railroad. Non-commercial people are not aware of the magnitude of the trade in sailing vessels around Cape Horn. One

thousand vessels laden with wheat voyaged from California to England last year, and this single item is not very large compared with the aggregate. Two great commercial nations like the United States and Great Britain will hardly be guilty of the folly of building a canal without being assured of its accessibility to the class of vessels relied on for cheap transportation.

This apparently insuperable objection does not apply to the Nicaragua route. Besides, this route has the advantage of greatly shortening the length of the voyage between the eastern and western shores of the United States, which fact alone makes it a favorite in this country. It is also the favorite route in England, chiefly for the reasons given by Commodore Maury. It is not likely, therefore, that M. De Lesseps will succeed in obtaining much aid for his Panama canal in either of the two countries most interested in a water communication between the waters of the Gulf and the Pacific.—*Globe-Democrat.*

ASPHALT FOR STREETS AND ROADS.

W. H. DELANO, C. E.

Adopting the nomenclature of M. Léon Malo, which had received general sanction, the author considered asphalt as a combination of carbonate of lime and mineral bitumen produced by natural agency. Asphaltic mastic was the rock ground to powder, and mixed with a certain proportion of bitumen. Gritted asphalt mastic was asphalt mastic to which clean sharp sand had been added. Asphaltic or bituminous concrete was gritted asphalt mastic mixed when hot with dry flint or other stone. Boussingault's analysis of bitumen gave C 85, H 12, O 3. It was, therefore, an oxygenated hydro-carburet, and quite distinct from the preparations of gas-tar and pitch which were sometimes erroneously styled bitumens and asphalts. Powdered limestone should be white, and soft to the touch; if rough, it probably contained iron pyrites, silicates, crystals, etc. The presence of these substances was prejudicial, and if suspected, the limestones should be subjected to secondary analysis, directions for which were given. The proportion of bitumen to limestone in the natural asphalt should not exceed 10 per cent. for carriage-ways, indeed, less than that was preferable. For this latter purpose no asphalt should be specified which had not stood the test of at least three hot summers and three cold winters. These precautions being taken, the author was of the opinion that a well laid surface of compressed asphalt, 2 to 2⅝ inches thick, on a foundation of Portland cement concrete, 6 to 9 inches thick, was superior to all other carriage-ways. It was noiseless; hygienic, being impervious to urine and the liquids from dung; absorbed vibration; produced neither dust nor mud; was cheap, durable, and easily repaired, and the old material could be used again. The charge of slipperiness, which has been made against asphalt roadways in London, was not due to the material, but to the absence of provision for proper scavenging. In Paris, where the asphalt

was regularly scraped, washed, and swept, the complaint did not arise. In support of the assertion that climate did not affect the asphalt in London, a table of humidity was given, showing the means of six years (1873–8) observations to be —for Paris, 80.2; for London, 81.5. The cost of washing the roadways, when done systematically, and on a large scale, was much less than was generally supposed, and the advantages far more than counterbalanced the expense. In Paris, this compressed asphalt carriageways cost on the average, about 13s. per square yard on lime concrete 4 inches thick, but a thickness of 6 inches to 9 inches of Portland cement concrete was much preferable.—*Iron.*

OBJECTIONS TO CAPT. EADS' SHIP RAILROAD.

The Boston *Journal of Commerce* says: "Capt. Eads is at present before Congress urging a guarantee on $50,000,000, at the rate of 6 per cent. per annum, in order to give him the backbone to construct a railroad across the isthmus of Darien. He proposes to lift ships out of the water and drag them across the isthmus upon some kind of a railroad. The fallacy and absurdity of this, in an engineering point of view, has been very fairly shown by the recent experiment upon one of the New York packets. The steamer Nevada, of the State line, in coming into port ran ashore at Sandy Hook. Some difference of opinion between the officers and agents existed as to the damage which might or did exist. In order to settle it and know what repairs should be done, she was sent directly to the dock with a full cargo of pig iron on board. After getting her on the dock it was impossible to raise her on account of the weight of iron in the hold. The iron was discharged and put on canal boats alongside the dock. Shipmasters condemned the whole proceeding, saying that it must necessarily strain her and throw her out of line. The *American Ship*, in speaking of this, puts the very pertinent query: "If the attempt to lift a loaded ship out of the water, supported as she would be on her dock, without horizontally moving her plane of support, meets with condemnation at the hands of shipmasters and men capable of judging from experience, what must be that of the proposed project of Capt. Eads, not only of lifting out of water, but of transporting these large vessels, steamers, or others loaded with their cargoes across the isthmus."

THE SAINT-GOTHARD TUNNEL.

The meeting of the two headings took place at nine o'clock on the morning of the 29th of February. An immense amount of work still remains to be done before the tunnel will be ready for traffic, but this will doubtless be done before the close of the present year.

The idea of tunneling the Saint-Gothard grew out of the successful completion of the famous Mont Cenis tunnel, which put an end to the profitable

monopoly hitherto enjoyed by the great Swiss highways, in the transfer of passengers and merchandise between Italy, Switzerland, France and Germany. To open a new and direct railway route across the Alps, several projects were presented; but the Saint-Gothard line was finally selected as the best, chiefly for reasons of a political character. In 1871, the government of Italy, Switzerland and Germany concluded a treaty relative to its construction, location, etc., etc., agreeing to contribute the sum of 85,000,000 francs therefor, to be assigned as follows: Italy 45,000,000 francs, and Switzerland and Germany, each, 20,000,000 francs. A railway company was organized from a confederation of Swiss and Italian roads, and the contract for the work was awarded on the 7th of August, 1872, to M. Louis Favre. One of the conditions of the contract was, that the perforation should be completed within eight years from the date of signing, with a liberal premium (1000 francs per day) in case of completion at an earlier day, and an equivalent penalty in case of delay. As will be seen, M. Favre's estimate of his ability to complete the task within the time prescribed has been fully justified by the event, and that in spite of the fact that difficulties and delays of a most serious nature were met with, from the caving in of the rock and the irruption of water. This work has been accomplished in less time by five years than it required to pierce the Mont Cenis tunnel, which, up to the present achievement, was the longest tunnel in the world. This rapid work is to be ascribed to the great improvements made in the machinery and methods for drilling and tunneling, rather than to superior engineering skill, though this was of the highest order.

The line of the tunnel commences at Airolo, passes northwest under the Kastelhorn (2977 meters high), the St. Anna Glacier, the village of Andermatt, the river Reuss about at the Devil's Bridge, and emerges at Goeschenen, at the level of that village. The station at Airolo is 1145m. above the sea, the summit level is 1152.4m , and the Goeschenen level, 1109m. The cross section of the tunnel is the same as that of Mont Cenis. The total length of the tunnel proper is 14,920 meters.

When the tunnel is opened for traffic, with its railway connections completed, it will afford the shortest line of transit between the Mediterranean and the Rhine; and, considered in connection with the political and commercial relations of the nations whose interest it is intended to subserve, it may justly be regarded as the most important engineering work on the continent of Europe.—*Engineering and Mining Journal.*

The reclamation of arid lands by means of artesian wells has lately been seriously proposed and advocated in Congress. It is stated that there are no less than 900,000,000 acres of arid lands, situated chiefly in Arizona, Dakota, Idaho, Montana, New Mexico Utah, Wyoming, Colorado and Nevada, of which less than 1 per cent. has been sold by the government, and which must

remain practically a desert, unless some method is found to supply them with water. Of the above total of 900,000,000 acres, it is estimated that about 500,000,000, consisting of plain and valley land, only lacks this vivifying element to become susceptible of high cultivation; and of which not more than 3 per cent. can be reclaimed by the intelligent utilization of the existing rivers and small streams for irrigation. The remainder is of little value. Under these circumstances, the government has been urged to appropriate the sum of $50,000, for the purpose of sinking experimental artesian wells for the purposes of irrigation. Should the result demonstrate the utility of this experiment, it is held that there will be plenty of private capital forthcoming to continue and extend the work.

MEDICINE AND HYGIENE.

WINDOW GARDENING IN SMALL HOUSES.

BY MRS. M. W. HUDSON.

This is not a dissertation on the Aphis, nor a treatise on the ingredients of the soil and the proper humidity of the atmosphere, but a protest against giving the sunniest, and perhaps the only southern window in the house, to plants all winter.

The poetical idea that plants in the house have a refining influence, leads many women to keep "just a few," though her rooms are small and cold, fuel scarce and expensive, her windows few and her children sometimes many, and always dear.

Once having potted and brought her plants in, she actually forms an attachment for them or she would not tolerate the starved and half frozen things before her eyes for months. A polite way of accounting for the fact that a woman who really appreciates flowers can cherish the sickly and straggling plants that obscure so many windows in winter, would be to say that it is one of the mysteries of the feminine mind. It must be. Probably, also, it is the same mystery that blinds women to the fact that children in the background of a little window religiously curtained as to the upper half and devoted to flower pots and a bird cage below, have complexions like the inmates of a lunatic asylum or a "Shepherd's Fold."

A dozen times a day they are told: "Don't go near the window, children, you will upset the plants." At night the pots must all be lifted to the warmest corner, very often at the expense of a grudging word from her liege lord, who does not, however, give any good reason why he thinks them nuisances, and is inclined, notwithstanding his complaints, to humor his wife in the matter of a few plants if they afford her any pleasure, and she declares they do. Occa-

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sionally, to be sure, window plants in small houses are so well taken care of that they thrive and bloom and gladden all the household, but any housekeeper must know that they are nearly always matured by the exclusion of fresh air and the sacrifice of sunshine.

In small houses the ventilation for night, as well as day, must frequently be secured through the living room, and if plants have to be saved from freezing by keeping every crack in the windows closed, the sleepers must suffer. The common belief that plants in a sleeping room are injurious to health is unauthenticated in practical experience, except for this reason. The deleterious gases a few plants will exhale in a night have an insignificant effect on the human system compared with the influence of repeatedly breathed air, but the cheering effect of a few unseasonable flowers will not compensate for the lack of sunshine in the house.

Baby's playhouse should be just under the window where the flower stand is it will do him quite as much good to flatten his little nose against the glass and revel in the sunshine as it will do the bursting buds to drink it all day long. And when baby's mother sits down to sew and read, it will do her more good than all other tonics can to sit in the full glow of the vivifying sunlight.

Shaded rooms depress the spirits and benumb the mind as well as the body. It is a sanitary wrong that no intelligent wife and mother will be guilty of, to darken the windows and keep her family in perpetual gloom. The sunniest rooms in the house should be the living rooms, and the people in the house should have the benefit of the first seats before the shrine of light; not even heliotropes and roses should intervene. Homes that have enough windows to supply both the human inmates and plants with light and air, are of course not referred to here, and the woman who has time and space for the cultivation of flowers would not be of the nature that men love if she did not have them the year round, but since such a large proportion of western people live in small houses, few of them are sufficiently well lighted, and since window gardening in winter is becoming more general each year, because it is so constantly urged by seedsmen and florists as one of the things women should do, it seems time that some one entered a plea for the babies' rights.

RELATIVE DANGER OF ANÆSTHETICS.

BY DR. WIGHTMAN A. DROWNE, KANSAS CITY, MO.

The power of various substances to produce insensibility has long been known, and in all ages certain narcotic preparations have been employed to produce a more or less unconscious state so as to lull the pain during the performance of painful operations. It is needless to enumerate all the different anæsthetics employed. But what seems to interest us the most on the subject in the present day, is the vexed question: "What substance have we that affords the

most safety to the patient?" No complete anæsthetic is perfectly safe, as the following statistics, which were proved by the late Prof. Morgan, of Dublin, to be correct, shows; the relative fatality of each being as follows:

Ether	1 in 23,204.
Chloroform	1 in 2,873.
Mixture of chloroform and ether	1 in 5,558.
Betchloride of Methyline	1 in 5,000.

Nitrous oxide, (gas), not given. We also learn from this table two facts, viz: That chloroform is the most dangerous anæsthetic (given in the table) that could be used; that ether is about eight times safer, and proved by the same table to be the safest of all anæsthetics used. As regards nitrous oxide, few practitioners cannot but be aware of the startling fact, that occasionally, in the columns of the various publications, their attention is arrested by a paragraph, headed, "A Death from Gas," and, taking into consideration the number of deaths attributable to its use, that are never recorded, which occur in private practice, a high percentage of mortality, must of necessity, exist. And notwithstanding these facts, I noticed but recently, an advertisment, stating that nitrous oxide administered by the advertiser was absolutely free from danger. I am well aware that the theory has been that it was perfectly safe, but old and deeply rooted errors do not fall at one blow, especially when they derive support from the extravagances of the opposition. The danger in the use of the nitrous oxide by inhalation, lies chiefly in the risk of an overdose being taken; as unconsciousness creeps on, the motor power is involved, and then the amount taken may be, and too often is, far beyond what was intended. Even practitioners of lengthened experiences, who are wedded to the use of nitrous oxide, and who believe that there is no danger in it when properly administered, because they were fortunate enough never to be present at a fatal result during its administration, must have seen hair-breadth escapes, where the pulse suddenly became almost, or even quite imperceptible, the features became livid, the pupils were widely dilated, there was a state of general muscular rigidity; in short, all the phenomena of the first stage of an epileptic fit was present and the patient only recovered from the jaws of death by the use of artificial respiration, and other means, resorted to during those apprehensive moments; a time of the most painful anxiety to the practitioner, to say nothing about the delay in the operation, the apprehension of the attendants, friends, &c. Such consequences occur sufficiently often to allow all to be conversant with the fact that, no matter whether a stethoscopic examination of the heart reveals that organ to be free from organic disease or not, still there is danger. In the administration of this anæsthetic the practitioner often times fails to ascertain this for himself, but trusts to the mere statement of the patient. There is nothing more common than for a dyspeptic patient to say, "I never have a headache; I may eat and drink what I please, my stomach never troubles me." True, but his heart does; and careful examination would discover that his stomach is not so perfect as he represents it to be. It is precisely the same with a neuralgic patient with a decayed molar tooth. "You need not look there," he says,

"I never have the toothache," but he winces when we touch the tooth. I will make the assertion, that there is not a city in the country, but has confined invalids whose condition is attributable to the use of nitrous oxide. Patients have been known to leave the rooms of the practitioner, immediately after having been under its influence, apparently free from any injurious effects, but in a short space of time have become debilitated in their health, and ruined; and in many instances ignorant as to the cause of their condition. From all that has been written and said on the dangerous effects, my opinion is, that practitioners are not justified, without a very good reason, in using what has been proved to be a dangerous anæsthetic.

ARCHÆOLOGY.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY, Dec. 3, 1879.

(EXTRACT.)

Mr. F. W. Putnam read an interesting account of his explorations of the ancient mounds and burial places in the Cumberland Valley, Tennessee. The excavations had been carried on by himself, assisted by Mr. Edwin Curtiss, for over two years, for the benefit of the Peabody Museum at Cambridge. During this time many mounds of various kinds had been thoroughly explored, and several thousand of the singular stone graves of the mound builders of Tennessee had been carefully opened. The material obtained from the explorations is now arranged on exhibition in the Peabody Museum. Mr. Putnam's remarks were illustrated by drawings of several hundred objects obtained from the graves and mounds, particularly to show the great variety of articles of pottery and several large and many unique forms of implements of chipped flint. He also exhibited and explained in detail a map of a walled town of this old nation. This town was situated on the Lindsley estate, in the bend of Spring creek. The earth embankment, with its accompanying ditch, encircled an area of about twelve acres. Within this enclosure there was one large mound with a flat top, fifteen feet high, one hundred and thirty feet long and ninety feet wide, which was found not to be a burial mound. Another mound near the large one, about fifty feet in diameter, and only a few feet high, contained sixty human skeletons, each in a carefully made stone grave, the graves being arranged in two rows, forming the four sides of a square, and in three layers. From these graves many interesting articles were obtained. The most important discovery he made within the enclosure was that of finding the remains of the houses of the people who lived in this old town. Of them about seventy were traced out, and located on the map by Prof. Buchanan, of Lebanon, who made the survey for Mr.

Putnam. Under the floors of hard clay which was in places much burnt, Mr. Putnam found the graves of children. As only the bodies of adults had been placed in one mound devoted to burial, and as nearly every site of a house he explored had from one to four graves of children under the clay floor, he was convinced that it was a regular custom to bury the children in that way. He also found that the children had been undoubtedly treated with affection, as in their small graves were found many of the best pieces of pottery he obtained, and also quantities of shell-beads, several large pearls, and many other objects which were probably the playthings of the little ones while living.*

Mr. Putnam also made a communication on the principles involved in the ornamentation of the pottery of some of the ancient nations of America, with particular reference to that from the Cumberland Valley in Tennessee, and from Nicaragua; illustrating his subject by a fine series of vessels of various shapes, selected from the Peabody Museum of American Archæology and Ethnology.

After a general review of the methods of ornamentation employed by American nations of the past, he showed that, by a study of such large collections as those in the Peabody Museum, the artistic development of the ancient peoples of America was far greater than generally stated by writers; and that the art of ornamentation had, in many instances, risen above the simple patterns made by incised lines, rude stamps, and other early and crude forms. Both in color and plastic work, a realistic art had been produced which had often resulted in conventionalisms of great interest.

He also stated that a study of this ancient pottery, with these principles of conventionalism borne in mind, would not only place some of these ancient American nations in a much higher artistic period than formerly supposed, but would lead to the understanding of many of the singular ornaments on the ancient vessels, many of which, without this knowledge of the existence of realistic and conventional art, would be looked upon as crude and meaningless attempts at ornament, whereas, as he showed by several series of specimens, the simple knobs arranged symmetrically about a pot or water bottle, were instances of pure conventionalism from realistic forms, and prove that a comparatively high attainment in the decorative art had been reached.

A proper and careful study of the principles involved by this interpretation of the artistic developement of the ceramic art in America, he thought, would in time furnish means of making comparisons in regard to the probable connection of one ancient American nation with another, and also an understanding of many of the singular resemblances between widely separated peoples. Still, he said, the whole subject was yet in its infancy, and the connection of one ancient people with another in America, can at present only be suggested from very unsatisfactory data.

* A detailed account of this exploration with many illustrations will be found in the 11th report of the Peabody Museum, and in the 3rd volume of the Kansas City REVIEW.

RAU'S PALENQUE TABLET.

PROF. O. T. MASON, COLUMBIA COLLEGE, WASHINGTON, D. C.

The last contribution to knowledge issued by the Smithsonian Institute, is No. 331 of its publications, a quarto of seventy-six pages, by Dr. Charles Rau, on the Palenque Tablet in the United States National Museum. The contents of the work are as follows: "Chapter I.—History of the Palenque Tablet; Chapter II.—Explorations of Palenque; Chapter III.—The Temple of the Cross; Chapter IV.—The Group of the Cross; Chapter V.—Aboriginal Writing in Mexico, Yucatan and Central America; Appendix.—Notes on the Ruins of Yucatan and Central America." In the first chapter we have a minute relation of the manner in which the tablet found its way from the Temple of the Cross to its present position in the National Museum. In the second chapter Dr. Rau gives a narration of various explorations of these interesting ruins. The name Palenques derived from a village about eight miles away, called Santo Domingo del Palenque. The ruins were discovered in 1750, by a party of Spaniards, and surveyed for the first time by order of Ramon de Ordonez in 1773–1784. The first exploration which led to any result was that of Capt Antonio del Rio in 1787; his manuscript was published in London, in 1822, with drawings from Castaneda, the artist of Dupaix. Capt. William Dupaix, in 1808, visited Palenque, with an artist named Castaneda. The MSS. and drawings will be found in Vols. IV, V, VI, of Kingsborough. Baron de Waldeck lived two years at Palenque, making surveys and sketches, 1832–4. His plates, with text by De Bourbourg, were published in Paris, in 1866, by the French Government.

When Dupaix visited Palenque the three slabs constituting the Group of the Cross were all in place. But at the time of Waldeck's visit, the right one, now called the Smithsonian Tablet, was in fragments on the floor; the middle one had been carried off to the banks of the river by a vandal who wished to adorn his house with it; and the one on the left was in its original position, which it now occupies. Stephens and Catherwood visited the spot in 1840, and were entertained by Mr. Charles Russel, our consul at Laguna. They made drawings of the ruins, and shortly after their visit the fragments of the right hand slab were sent to the National Institute in Washington, where it arrived in 1842. The site has since been visited by Arthur Morlet in 1846, and M. Dèsirè Charnay, for the French Government, in 1857. The tablet was transferred to the Smithsonian Institution 1858, and in 1863, while making a cast for Prof. Henry, Dr. George A. Matile discovered that this was the missing slab from the Palenque group, not drawn by explorers after Dupaix. It was broken again after Dr. Matile's cast was made, but reconstructed and set in its present frame, from which Dr. Rau's photograph was taken. Whatever doubt may have remained after Matile's argument, is now dispelled by reference to the outline plate of Dr. Rau's work, in which the whole Group of the Cross is again restored.

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The occurrence of the sign of the cross in America anterior to its discovery by Columbus, has been the marvel of archæologists. But the fact of its appearance in many places where Christian influence had never been felt, compelled the student to look for other motives in its existence. The whole subject is reviewed in Chapter IV, pp. 39–46. Of equal interest with the allegorical sculpture is the subjects of the hieroglyphics, on which Dr. Rau has bestowed a great deal of faithful study. The supposed key to their interpretation is a MSS. found in the Royal Library of Madrid, by Brasseur de Bourbourg, in 1863, which is a copy of one composed by Diego de Landa, in 1579, and giving, among other things, an alphabet of thirty-three signs. It will be remembered that a similar old MSS. is mentioned by Sr. Orozcoy Berra, in Anales del Museo Nacional de Mexico, containing the Lord's Prayer in symbols, partly Aztec and partly ecclesiastic. All attempts to interpret the Central American glyphs and manuscripts by Landa's alphabet have proved failures. Dr. Rau, the most cautious of theorists, does not attempt a solution; but on page 61 gives a diagram of his outline plate, by which every glyph on the tablet may be easily referred to (it is a pity that the letters and figures do not occur on the margin of the plate itself). On pages 62 and 63, some of the glyphs are analyzed, and the places where the elements are to be found, are indicated. The author concludes that the analogies between Landa's signs and the glyphs warrant the suggestion that the inscriptions constitute a chronological record of some kind. On pages 53 and 64, Dr. Rau corrects an error of Humboldt, Kingsborough, Stephens and others, as to the close relationship between the Aztecs and ancient Mayas, based on the Dresden Codex, which is clearly shown to be of Maya and not of Mexican origin at all.

On page 75 the author reaffirms the view of Stevens, Bancroft, as well as his own, "that the Yucatan structures were built by the Mayas, the direct ancestors of the people found on the peninsula at the Conquest, and of the present native population.—*Amer. Naturalist.*

CHEMISTRY.

THE ARTIFICIAL FORMATION OF THE DIAMOND.*

BY J. B. HANNAY, F.R.S.., F.C.S.

While pursuing my researches into the solubility of solids in gases, I noticed that many bodies, such as silica, alumina, and oxide of zinc, which are insoluble in water at ordinary temperatures, dissolve to a very considerable extent when treated with water-gas at a very high pressure. It occurred to me that a solvent might be found for carbon; and, as gaseous solution nearly always yields crystal-

* A paper read before the Royal Society, February 26, 1880.

line solid on withdrawing the solvent or lowering its solvent power, it seemed probable that the carbon might be deposited in the crystalline state. After a large number of experiments, it was found that ordinary carbon, such as charcoal, lamp-black, or graphite, were not affected by the most probable solvents I could think of, chemical action taking the place of solution.

A curious reaction, however, was noticed, which seemed likely to yield carbon in the nascent state, and so allow of its being easily dissolved. When a gas containing carbon and hydrogen is heated under pressure in presence of certain metals, its hydrogen is attracted by the metal, and its carbon left free. This, as Prof. Stokes has suggested to me, may be explained by the discovery of Profs. Liveing and Dewar, that hydrogen has at very high temperatures a very strong affinity for certain metals, notably magnesium, forming extremely stable compounds therewith.

When the carbon is set free from the hydrocarbon in presence of a stable compound containing nitrogen, the whole being near a red-heat and under a very high pressure, the carbon is so acted upon by the nitrogen compound that it is obtained in the clear, transparent form of the diamond. The great difficulty lies in the construction of an inclosing vessel strong enough to withstand the enormous pressure and high temperature—tubes constructed on the gun-barrel principle (with a wrought-iron coil), of only half an inch bore and four inches external diameter, being torn open in nine cases out of ten.

The carbon obtained in the successful experiments is as hard as natural diamond, scratching all other crystals, and does not affect polarized light. I have obtained crystals with curved faces belonging to the octahedral form, and diamond is the only substance crystallizing in this manner. The crystals burn easily on thin platinum-foil over a good blow-pipe, and leave no residue, and, after two days' immersion in hydrofluoric acid, they show no sign of dissolving, even when boiled. On heating a splinter in the electric arc, it turned black—a very characteristic reaction of diamond.

Lastly, a little apparatus was constructed for effecting a combustion of the crystals and determining their composition. The ordinary organic analysis method was used, but the diamond crystals were laid on a thin piece of platinum-foil, and this was ignited by an electric current, and the combustion conducted in pure oxygen. The result obtained was, that the sample (14 m. grms.) contained 97.85 per cent of carbon—a very close approximation, considering the small quantity at my disposal. The apparatus and all analyses will be fully described in a future paper.

The specific gravity of the diamond I have obtained ranges as high as 3.5, this being determined by flotation, using a mixture of bromide and fluoride of arsenic.—*London Chemical News.*

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DOMESTIC ILLUMINATION BY ELECTRICITY.

A French paper states that Dr. Phipson has proposed a new solution of the question relative to a cheap means of illumination for domestic purposes. He has succeeded in augmenting considerably, by means of a comparatively weak electric current, the phosphorescence of certain substances influenced by the solar rays. He incloses within a Geissler tube a phosphorescent substance, such as the sulphide of barium, and causes the tube to be traversed by a constant current of a certain intensity. By this means, it is stated, a uniform and agreeable light may be obtained at a less cost than by means of gas. The *Electrician* understands that Dr. Lyon Playfair has adopted the Jablochkoff system for partially lighting his own residence.

It is not surprising that barley, potatoes and many other plants and vegetables ripen in the most northern latitudes, seeing that they are exposed to a considerable amount of heat during two or three months of the year. In those regions where the sun hardly descends below the horizon in summer there is no night, only a short twilight; the growing plant, therefore, enjoys permanently, and without interruption, the heat and light which it requires.

One of the silk manufacturing firms of Lyons is introducing the production of photographic impressions on stuffs. They sent to a recent meeting of the Photographic Society several pieces of silk with a variety of photographic pictures printed thereon, including, among others, a number of large medallions representing pictures of the old masters. The length of the specimens thus exhibited is stated as being no less than 131 feet. The process by which they are produced is not given, but it is believed that the prints are made with salts of silver.

An ingenious and simple apparatus for making a bell ring at any predetermined hour of the day is described in a recent number of *L' Electricite*. It comprises a lens by means of which the solar rays are concentrated and directed on the metallic strip, which is susceptible of very rapid and great dilatations. The result of the dilatation is electric contact, giving passage to a battery current which rings the bell. Although the sun may be covered by clouds, its calorific power is never diminished so much as not to dilate the strip.

BOOK NOTICES.

THE NORTH AMERICANS OF ANTIQUITY—THEIR ORIGIN, MIGRATIONS, AND TYPE OF CIVILIZATION CONSIDERED. By John H. Short. Octavo, pp. 544. Harper & Brothers, New York, 1880. For sale by H. H. Shepard; $3.

The subject of American Archæology is one of growing interest and importance. Everywhere throughout the country new discoveries are being made, bringing to light traces of the ancient inhabitants of America and new material for their history. The work before us is one of the latest and best which has appeared on this subject. While of a necessity there is much that has appeared before in works of this character, there is also much that is new; and, although not professing to be an exhaustive history of the native races, like Bancroft's, it gives us a concise summary of all that is known to date in regard to the ancient inhabitants of America, with copious bibliographical references for the use of those who wish to examine for themselves the authorities quoted. Passing from the Mound Builders of the older States, he presents us with a full and comprehensive account of the new field of archæology lately opened up in Colorado—the Cliff Dwellers; and thence to Central America and Mexico. The chapters on the Mayas and Nahuas are especially interesting, presenting us with the latest discoveries in the ruined cities of this region, and the efforts made to decipher their hieroglyphics. Here is yet a grand field for discovery. While Waldeck, Dupaix, Stephens, and Squier have done good work in this region, they have but skimmed the surface, so to speak, and much yet remains for the enterprising traveler. Witness the tablets and splendid statue of Chac Mol, the Maya demi-god, exhumed by Dr. Le Plongeon and his wife, at Chichen-Itza, in Yucatan: "The statue represents the reclining figure of a man who is naked, except that he is adorned with a head-dress and bracelets and garters of feathers, and sandals similar to those found upon the mummies of the ancient Gananches of the Canary Islands."

This statue was seized by the Mexican officials and sent to the capital. Its exact duplicate was found some years later under the Plaza of the City of Mexico, proving that the tribe whose king or god it was, must have migrated southward, as the one excavated in Mexico shows greater age than the one from Yucatan. Who are they, whence came they, and whither did they go? are the questions the traveler asks himself as he gazes upon the magnificent works of these people rising grand and lonely before him in the unbroken forests and on the wild headlands of the sea coast. Paintings and relievos, "worthy to be compared to the most beautiful works of the days of Augustus," adorn their inner walls, while sculptured façades, statues, towers and temples in bewildering confusion rival in their splendor and magnificence the works of ancient Egypt in her palmiest days. And yet—most tantalizing of all—these strange people have left their historical records behind them graven in imperishable stone, which, as yet, no one can decipher;

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and the "stony-eyed statues" seem with a mocking smile to point the inquisitive traveler to the tablets in which they have locked up their secrets in undecipherable hieroglyphics. Many efforts have been made to read these characters, especially by the Abbè Brasseur de Bourbourg; but the results so far, to say the least, have been unreliable and unsatisfactory. As yet, no Rossetta stone has been found to give us a key to these ancient records.

The book is fully and judiciously illustrated, and the publishers have done their part in their usual excellent manner. L.

OUR HOMES. By Prof. Henry Hartshorne, A.M., M.D. Philadelphia: Presley Blakiston, 1880; 150 pp., 16mo; 50c.

This is by far the most important of the valuable and popular series of American Health Primers, now published by Presley Blakiston, who has succeeded Lindsay & Blakiston. The preceding numbers contained descriptions of and directions for the management of various diseases of the body, all of which are more or less dependent upon the hygienic condition of our homes. Certain it is that if our dwellings were constructed upon strict sanitary principles, our throats, lungs, ears, eyes, and even our brains, would be better guarded against disease than in any other way that can be devised. As is well known, more than half of the illness of the people is due to badly ventilated, imperfectly warmed and poorly lighted houses, while a great portion of the other half is attributable to foul drinking water and defective drainage; so that if the teachings of Dr. Hartshorne on these subjects be carefully heeded, we may almost expect to be free from most of the diseases so common in all families. If this book cost $5 instead of 50c, it would be cheap to any man about to build a family residence, either for himself or for rent.

ILLUSTRATED HISTORY OF ANCIENT LITERATURE. By John D. Quackenbos, A.M., M.D. Harper & Brothers, 1878; pp. 432, 12mo. For sale by W. H. V. Raymond, publishers' agent, Kansas City; $1.25.

This volume is intended as a text-book in the schools, but need not be necessarily regarded as a school book, since it will be found most valuable and interesting to the general reader and as a book of reference for the writer and student of larger growth. It presents a full account of the literatures of ancient nations, and, in treating of the origin and relationships of their respective languages, incidentally bring forward some of the most interesting facts of comparative Philology. While the works of the Greek and Roman writers are fully discussed, the principles of the Egyptian hieroglyphic writing are explained, and the vast treasures exhumed by recent explorers of the ruins of the valley of the Nile and elsewhere, are described and illustrated. No text-book that we have seen seems better calculated to arouse in the minds of students a love of literature and literary pursuits for their own sake, or of ancient history and philology as suggested subjects.

XUM

PREVENTION AMD CURE OF CHRONIC CONSUMPTION. By David Wark, M.D. New York, Authors' Publishing Co., 1880; 12mo, 103 pp.; 80c.

The author's theory is that the pulmonary congestion may be relieved by certain manipulations of the limbs and extremities which shall induce a flow of blood from the affected point to them, the patient to be entirely at rest and the manipulating performed by an attendant. This treatment, however, is not to be applied in lieu of medicines, but in connection with them. A number of cases, where beneficial results have followed this treatment, are reported, and the President of the Authors' Publishing Company himself voluntarily testifies to having been cured by adopting the treatment, while the book was in the hands of their "reader." and printer.

POPULAR ASTRONOMY. By Simon Newcomb, LL.D. Harper & Brothers, New York, 1880. Octavo, pp. 577. For sale by W. H. V. Raymond, publishers' agent, Kansas City; $1.30.

It is saying very little, considering the eminent ability and position of the author, to state that it is the best school astronomy we have ever seen, and probably the best ever published. Prof. Newcomb is Superintendent of the American Nautical Almanac, and formerly Professor at the United States Naval Observatory, and, of course, brings to his work a large experience and the latest possible results of astronomical research. Beginning with the work of the ancient astronomers of Egypt, Chaldea and Greece, he gives a complete summary of the progress in discovery and invention down to the present day, the whole being written in a clear and simple style, alike attractive and instructive to the student and the general reader.

The work is illustrated with 112 engravings and five maps of the stars, and is just such a work as every intelligent reader, not a professional investigator, will be gratified to have at hand.

ROMAN CATHOLICISM IN THE UNITED STATES. Anonymous. Authors' Publishing Co., New York, 1879; 12mo, 190 pp.; $1.25.

We quote as follows from the prospectus, only suggesting that, so far as we can judge, the subject is treated candidly and plainly. The mechanical work is first-class—creditable to the publishers in every respect:

"The author of this book is the author of several well-known thoughtful works. He withholds his name from this simply that its spirit of impartiality and unwavering fairness may not suffer by prejudgment. He treats his subject with persistent candor and rigid honesty. He minces nothing and omits nothing for want of frankness which either the subject or argument involves. He lays hold of a stupendous theme, and treats it manfully. He plays with nothing. His style is simple and direct. His logic is gigantic, if indeed it be not absolutely invincible.

XUM

"The year—and possibly the decade—has not produced a more important work. With almost equal certainty, it has not produced one that is better written. These are strong assertions, but they are carefully, cautiously made. The book will more than sustain them."

THE TAXIDERMIST'S MANUAL. By Capt. Thomas Brown, F.L.S., London, England. G. P. Putnam's Sons, New York, 1879 For sale by M. H. Dickinson; $1.25.

To every casual observer of zoölogical specimens, as found in the average museums, it would certainly seem that so good a book as this had never been written, much less that it had reached its twenty-eighth edition; while to one well acquainted with the appearance and habits of the living creatures themselves, these miserable travesty of nature suggest that the manipulator not only never had read a book on the subject, but had lived with his eyes shut and made up the specimens solely by the guidance of a distorted imagination.

Not only will this work be found a guide to taxidermists in making life-like preparations, but also in all the details of tools, materials, preservatives, and handling of birds and mammals, as well as shells, insects, fishes and reptiles. The writer has had an abundant and varied experience, which has enabled him to appreciate and meet the learner's wants; and this, in our judgment, he has well done. The engravings seem to be just what the beginner will need to give him the proper start in the work, and the descriptions are clear and precise.

OTHER PUBLICATIONS RECEIVED.

Introduction to the study of Sign Language among the North American Indians by Lieutenant Col. Garrick Mallory, U. S. A.; The Approximate Solution of Kepler's Problem, by H. A. Howe, A. M., Cincinnati Observatory; On the Extra-Meridian Determination of Time, by means of a portable transit instrument, by Ormond Stone, A. M., Astronomer at the Cincinnati Observatory. The Kansas Review, Lawrence, March '80, monthly, 75cts. National Journal of Education, Boston and Chicago, weekly, $3.00. Quarterly Report of the Kansas Agricultural Board, 1879, J. K. Hudson, Secretary. Le Technologiste, 40th volume, weekly, 25 francs per annum. Johns Hopkins University Circulars. Feb., 1880. The Conservative, monthly, March, 1880. The Oriental and Biblical Journal, Clinton, Wis., quarterly, $2.00. Second annual Report of the State Board of Health of Colorado. National Literary Monthly, Toledo, Ohio, March, 1880, $1.50.

SCIENTIFIC MISCELLANY.

A STEAM ROAD WAGON.

During the winter months Prof. Saroni has been busy in perfecting his steam wagon, and he will this week forward his model of the machinery to Washington, D. C., for the purpose of securing letters patent on it, he having so far been operating under a simple caveat. Since the appearance of the apparatus upon the streets last fall it has been vastly improved. By a double system of clutches and pulleys, one at each end of the driving shaft, the power can be applied for speed or for slow work with heavy draught. But the greatest novelty that has been introduced into the machinery is a system of propulsion for use in case of ascending a steep hill. Taking an idea from the fact that a horse can draw a much heavier load than its own weight, the inventor has introduced two sets of levers that correspond exactly in movement and in the application of power with the two hind legs of horses, the one alternating with the other, precisely as do the limbs of the animal. It is difficult, without diagrams, to illustrate how this is accomplished, but its effect can be understood with sufficient clearness from the foregoing comparison. The second important advance made is in a device for the rapid generation of steam, which is a marvel of ingenuity, as well as a marvel of success. As formerly, gasoline is the fuel employed, and the flame is made to play upon pumice stone, which heats to a whiteness, and thus not only creates a reservoir of constant heat, but should the flame be temporarily extinguished by a sudden jerk of the machinery, as it is apt to be, it is instantly rekindled. The pumice stone occupies the fire box, above which are arranged coils of pipe containing the water, which are so arranged as to give the water both lateral and longitudinal motion, and to permit the sediment to settle in the lower pipes on the side of the fire-box, where it can be readily taken out. A second and smaller boiler is used to generate steam first, and this superheated steam is conducted to a nozzle, at the end of which and below it is placed a second nozzle. This portion of the apparatus is similar to the atomizers which are so familiarly known and used in procuring fine spray from bottles of perfume, and the action of the steam atomizer invented by Prof. Saroni, is precisely similer to that of a perfume bottle. The jet of superheated steam, as it emerges from the nozzle immediately below the steam nozzle, and steam and gas are together projected into the fire-box in that infinitely divided condition so favorable to chemical combination, resulting in intense combustion and the rapid production of heat. As soon as the pumice-stone has thus been sufficiently heated, the atomizers are shut off and the ordinary service jets are turned on. By this means steam can be generated from cold water to a pressure of 100 pounds in four

minutes. It may be added that the "leg propulsion," if it may be so termed, can be used with or without the slow-motion pulley, or the locomotive apparatus may be entirely uncoupled, and the power applied to driving a threshing machine, with the wagon remaining stationary.—*Pioneer Press.*

A NEW WAY OF STUDYING SOUNDS.

The London *Times* reports that a new and simple way of producing colored rings, which seems capable of some interesting applications, has been recently brought to public notice by M. Gebhard. A saucer filled with not very pure mercury is all the apparatus required. Then clear off with a piece of paper the thin pellicle of oxide and dust, breathe on the bright surface, and a magnificent system of colored rings is given by the film of condensed moisture then formed. Instead of the four or five "irises" described by Newton, six or seven can be well made out, and the thickness of the film increasing from the borders inwards, the order of hues is reversed. Still better effects can be got by dropping volatile substances (as petroleum oil) on the mercury surface, instead of breathing on it; but the most remarkable results are made with the collodion. Diluted with ether, this gives pellicles on the mercury, which may be detached (after their thickness and colors have been regulated at will) and transferred to paper. M. Gebhard has utilized these effects in study of the sounds of the voice. Vocal sounds uttered above the moistened mercury surface produce characteristic ring figures which throw new light on the nature of the vibrations involved. The vibratory state, indeed, few vowel sounds, appears to be very complex, the figures presenting groups of several ring systems, including several centers of percussion.

THE MAGNET IN MILLING.

Magnets and magnetic separators are a comparatively new thing in milling; but perhaps there is no contrivance imployed in our mills whose utility is so unquestioned, or which has grown into such wide use in so short a time, as the magnet in the forms of gangs and separators. Many who at first sight saw nothing objectionable in wire-bound wheat, were soon loudest in their clamors against it. They had relied upon cleaning machinery of unquestioned excellence to remove what bits of wire should chance to find their way in to the wheat; but time soon showed that the crooked little pieces of wire would work their way through the cleaning machinery, thence go to the buhrs, where they were flattened out into saws, and then to the bolts, where they played havoc with the cloth. In some sections where the wire binder was exclusively used, bits of wire could be traced even into the bread, and be found in an incomprehensible abundance in mill products. It got into the bran and choked cattle fed on it.

It blackened the buhrs and destroyed the bolting cloths. In fact, wire in wheat became an unbearable nuisance in spite of every precaution against it—and then came the magnet.

Never did so simple a remedy cure such widespread dissatisfaction. Millers' associations had tabooed the wire-binder and passed resolutions favoring a discrimination in price against wire-bound wheat. This journal had declaimed against it until it felt hoarse; but the magnet removed every objection to the wire-binder by taking out the insidious bits of wire. Every miller who tried the remedy was satisfied, and the clamor ceased. The truth is, that the introduction of magnets as a grain cleaning agency opened the eyes of millers to a few facts of which they had been ignorant before. Most of us knew that the magnets would show that wire existed where its presence was never suspected; but who would have looked for such a collection of metallic odds and ends as these separators bring to light? In the course of a day a large merchant mill will take from its wheat, by means of magnets, a miniature junk shop. You will find everything represented, from ten-penny nails down to bits of iron as small as a pin head. How all of it got into the wheat is a mystery; but one thing is certain, that much of this iron must formerly have gone to the buhrs and bolts; and, even if the wire-binder had never been invented, magnetic separators would find a useful place in every mill.—*American Miller.*

EDITORIAL NOTES.

THE present number concludes the third volume of the REVIEW, and again our thanks are due to the generous patrons at home and abroad who have aided in supporting it. Its field of usefulness has been materially extended during the past year through the enlightened liberality of appreciating friends, so that it has found its way to nearly every portion of the globe, and, from the words of approval that have reached us from many highly esteemed literary and scientific gentlemen, far and near, we draw the gratifying conclusion that its editorial management has been successful. This alone is sufficient to encourage us to continue its publication and to give to its improvement in every respect, increased effort; for while we naturally desire to have the REVIEW self-supporting, it must be very clear to everybody that there can be no pecuniary profit resulting from it. To achieve in so short a time, the prominent position among the periodicals of the day which is accorded to it, is remarkable, and is of course attributable to the excellent quality of the articles contributed to its pages and the diversity and appropriateness of the subjects discussed.

ON Thursday, Friday and Saturday, March 25th, 26th and 27th, a wind storm raged through the West and Southwest, extending from Texas across Kansas and Missouri, over a track from fifty to 200 miles in width, into Illinois, doing considerable damage to buildings, fences, etc. Winfield, Kansas, seems to have been the greatest sufferer, a number of buildings having been destroyed and several persons seriously injured.

Observations taken by Sergeant Weber at the Signal Service Office shows St. Louis to have been near the center of a very low at-

mospheric pressure, the barometer in Texas indicating one inch higher.

The St. Louis *Globe-Democrat* says:

Since the establishing of the Signal Service Station at this city there have been but two such storms of wind experienced, the first on the 18th of May, 1878, when the wind attained a similar velocity, and on the 4th of August, 1878, when a gale traversed the city at the rate of seventy-two miles per hour.

The average velocity of the storm of the 27th, from 6 a. m. to 12 m., was thirty-eight miles per hour, and while at its maximum force the pressure was sixteen pounds to the square foot.

At Leavenworth the maximum velocity of the wind was thirty-six miles per hour, and the average for thirty-four hours was 25.2 miles per hour. Here at Kansas City it was less than half as great for the same time.

PREMIUMS TO SUBSCRIBERS.

We again call attention to the plan which has proved so appropriate and acceptable for giving premiums to our subscribers for the last two years, viz:

To any person who sends us $3.50 we will send the REVIEW, for one year, and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clarke & Co., Houghton, Osgood & Co., Roberts Brothers, J. B. Lippincott & Co., John Wiley & Sons, Henry C. Lea, S. R. Wells & Co., Ivison, Blakeman, Taylor & Co., Harper & Bros, or Orange Judd & Co.

To any one sending us $3.75, we will send the REVIEW for one year and any $2.00 book published by any of the above firms.

Persons desiring to subscribe for the REVIEW and purchase any book or books, or subscribe for any other periodical, published or attainable in this country, can obtain special rates by applying to the editor in person or by letter.

Clubs desirous of subscribing for the REVIEW can have the same privilege as single individuals, besides the advantage of reduced rates of subscription.

To persons wishing to purchase law, medical, scientific or miscellaneous books, and at the same time subscribe for a periodical which includes within its scope popular articles upon all branches of science, mechanic arts and literature, we deem this a particularly favorable offer.

THE astronomical lecture of Prof. Proctor, of London, before the Kansas City Academy of Science, on the 26th ult., was extremely interesting, and would have been very largely attended except for an unfortunate rain storm just at the hour of commencement, which kept hundreds away.

The skillful management of the oxy-hydrogen light by Prof. E. C. Crosby, of this city, contributed largely to the success of the entertainment.

The lecture of Judge Arnold Krekel before the Academy on Tuesday evening, March 30, was a concise history and masterly exposition of the "Monroe Doctrine" from the earlier days of the Republic down to the present time, and was listened to with marked attention by a full house.

THE annual commencement exercises of the Kansas City College of Physicians and Surgeons, on March 2, attracted a large audience, which was well entertained by Rev. Dr. Bell, J. V. C. Karnes, Esq., Prof. Geo. Halley, and Mr. Schenck who delivered the class valedictory. The regular prizes all fell to students from Kansas this year. The standard of excellence fixed by this institution for graduates is unusually high, which is not only creditable to it at present, but will insure good returns in the future.

WITH no disposition to boast, but merely for the purpose of showing concisely what we have done in the past year, we will say that there have appeared in the REVIEW no less than one hundred and eighty articles expressly written for or contributed to it, classified under the various heads of Geography, Anthropology, Astronomy, Geology and Palæontology, Foreign and Domestic correspondence, Meteorology, Mining and Metallurgy, Book notices, Chemistry, Botany, Archæology, Physics, Evolution, Political

Science, Reports of Proceedings of Societies, Medicine and Hygiene, Ornithology, Necrology, Technology, Engineering, Education, etc.

In addition to all this, Selections on all these topics and many more have been republished from the leading scientific journals of the world; while the Editorial Notes have been intended as a running commentary upon current scientific discoveries, natural phenomena, notable magazine articles, etc.

In short, we believe we do not exaggerate when we say that the three volumes of the REVIEW will compare favorably in point of popular interest and reliable, useful information, with any similar periodical of the country, and for proof of this we refer our readers to the index which accompanies this number.

THE Merchants' Exchange of St. Louis, on the 8th of March, passed a series of resolutions relative to the Signal Service of the United States, in which they express their appreciation of the incalculable advantages and benefits in everything connected with the vast commercial and industrial interests of the Mississippi Valley derived by the merchants of that city from it, speak in the highest terms of commendation of the successful labors of Gen. Myer and his assistants, and recommend that his suggestions for its improvement and extension be favorably received by Congress.

MR. JOSEPH SAVAGE, Secretary of the Mudge Monument Fund, reports that between two and three hundred dollars have been raised or pledged for that fund already.

WE are occasionally obliged to decline a valuable article on account of its exclusively technical character, and we take this occasion to repeat what we have said before, that the main object of the REVIEW is to entertain and instruct by means of popular articles rather than to offer problems in science, adapted to profound students, and which the majority of our readers, being professional men and merchants, have neither time nor inclination to work out. To this cause more than to anything else we attribute the increased circulation of the REVIEW in this busy city and it will be our constant object to make it more and more popular with every succeeding issue.

THE very heavy rain storm of Friday night, March 26, was followed on the next day by a very heavy west wind and an intensely and peculiarly hazy appearance of the sky, almost like a partial eclipse of the sun; which gave rise to all kinds of speculations on the part of observers, the trees, houses and fences being whitened as with frost, though the mercury stood at 55°. It was finally decided to be caused by vast quantities of fine sand or dust, carried along in the atmosphere, and it was still later discovered that it had been borne by the wind from beyond the limits of the rain storm, which extended north and west a distance of nearly 100 miles.

ON April 13, Rev. Richard Cordley, D.D., of Emporia, Kansas, one of the ablest divines of the State, as well as one of the most interesting speakers, will deliver the sixth lecture of the extra winter course before the Kansas City Academy of Science, upon the subject of Patience in Culture and Investigation. These lectures have given excellent satisfaction to our people so far, and this one will prove no exception to the rule.

THE election of Major J. K. Hudson to the position of Secretary of the Kansas State Board of Agriculture, to succeed the late Alfred Gray, insures, in our opinion, an intelligent, active continuation of the plan of State development so admirably inaugurated and so successfully conducted by the latter during the past ten years.

WE have received from the Graphic Co., of New York, some samples of their reproductions in photo-lithography, of steel engravings, which approximate very closely to the originals themselves; yet they are printed on first-class paper, sold and forwarded post paid, for about one-tenth of the price.

PROF. J. S. E. DREYER, of the Royal Dublin Astronomical Society, writes thus pleasantly of the REVIEW:

"I have read a great many of the articles with the greatest pleasure, and hope you will be kind enough to send me the remaining numbers of the volume, as I would like to have it complete and get it bound."

OUR grateful thanks are due to our exchanges, both in this country and Europe, for uniform courtesy and frequent complimentary notices, and, more than all, for the appreciation of our articles manifested by their reprinting many of them on both sides of the Atlantic. These favors we attempt, as far as our space will permit, to repay in kind whenever opportunity occurs.

ALL persons desiring to have their back numbers of the REVIEW bound, as heretofore, in morocco backs and cloth sides, can have it done for $1.00 per volume of twelve numbers, by leaving them with the editor or at the office of Messrs. Ramsey, Millett & Hudson, 224 and 226 West Fifth street.

The back numbers of the first and second volumes will be furnished at *half price* i. e. $1.25 per volume of twelve numbers, or $2.25 per volume, bound as above. *The back numbers of the third volume*, being quite scarce, can only be furnished at the *regular rates*.

ITEMS FROM THE PERIODICALS.

VAN NOSTRAND'S Magazine for April presents in its table of contents articles upon Retaining Walls, by Wm. Cain, C. E, (Illustrated); Compound Armor; The Absolute Zero of temperature, By J. F. Klein, D. E.; Dwelling Houses: Their Sanitary Construction and Arrangements, by Prof. W. H. Corfield, M. A., M. D., (Oxon) II; Bridging Navigable Waters of the United States, Report of Gen. G. K. Warren; The Nature of Electricity; The Panama Canal, by Captain Bedford Pim, R. N., M. P., parts II and III; The Measurement of Earthwork by the Prismoidal formula, by C. P. Aylen, B. C. E.; On the Hardening, Tempering and Annealing of Steel; Engineering Progress During the Last Fifty Years; address of William Henry Barlow, Esq., F. R. S.; Dynamo-Electric Machines, I. (Illustrated), and Editorial Notes.

GOOD COMPANY (Number seven) gives its usual quota of attractive and readable sketches, among which are an account by Charles Dudley Warner of a twenty-four hour expedition by "the Chaplain," "Old Phelps," the well known Adirondack guide, and himself, over an Adirondack mountain near Keene Flats; a tale of the South Pacific, by Edward Bellamy; and Through a Needle's Eye, by Katharine Carrington; An Idyl of New Mexico; Barberry Island; Modern Pictures from Italy; Father Quinnailon's Con. vert, by Octave Thanet; John Burroughs' Foot Paths, and Winter Greens, by E. S. Gilbert. Geo. M. Towle sketches John Bright; and Mrs. Wager-Fisher tells of Earnest Renan. The other articles include Wanted, by Mrs. Edward Ashley Walker; The Defense of Criminals; Some Frontier Art; besides poems, redolent of Spring, entitled Fairfield's Brook, Tokens and Altar Blossoms.

This number opens a new volume, which is published at $3.00 a year, in Springfield, Mass.

THE *American Entomologist*, from which we culled the very life-like article in our March number entitled Zoölogizing in Mammoth Caves, has in its April number, among many other appropriate articles, a very suggestive one by Edouard Perris, upon the relative usefulness to the farmer, of birds and insects, a question which perhaps has received less discriminating attention than almost any of equal importance.

THE *Farm*, a prominent agricultural and horticultural paper of Ireland, published in Dublin, and to which we are indebted for an exchange, has removed from 34 Dawson st., to 87 Marlboro' st. It will in future be under the editorial management of Thomas B.

Grant, for many years co-editor of the *Irish Farmers' Gazette.*

Golden Days. Under this title, Mr. James Everson, of Philadelphia, has commenced the publication of a paper for boys and girls, which aims to win them away from corrupting literature by furnishing them an antidote in the form of good, wholesome and cheap reading, presented in its most attractive form. This is a most praiseworthy object and purpose, and we hope that his success will be commensurate with his conscientious efforts in this direction.

The North American Review for April has for its leading article a paper intended to vindicate General McClellan against the charge that he was over cautious and unnecessarily slow in his movements, and contains many statements of an interesting character. Sir Francis Hincks contributes a paper on the Relations of Canada with the United States. The Rev. David Swing writes about The Failure of the Southern Pulpit. The discussion of the Third Term question, begun in February number of the Review, is continued in the present number by the Hon. Geo. S. Boutwell. Charles Stewart Parnell sets forth the reforms in the laws of land tenure which are advocated by himself and his political associates, under the heading, The Irish Land Question. The Book Notices are by Mr. Edward Cary.

THE *Oriental and Biblical Journal* is a quarterly magazine of handsome appearance, published by Jameson & Morse, 104 Clarke St., Chicago, Ill., and edited by Rev. S. D. Peet, Clinton, Wis. $2.00 per annum.

The object of this magazine is to give the results of the researches in Archæology in all Eastern lands, and to present the various phases of thought which may arise from Oriental studies, especially as they bear on the sacred Scriptures, Rev. Selah Merrill, D. D.; Rev. Howard Crosby, D. D.; Rev. Lyman Abbott, D. D.; Rev. A. H. Sayce, F. R. S; Rev. J. O. Payne, D. D.; Rev. James Strong, D. D., contributors.

THE April number of the *Popular Science Monthly*, in the variety, readableness, and substantial excellence of its articles, well sustains its reputation. Its contents are as follows: Progress and Poverty, by C. M. Lungren; What is Jupiter Doing? (illustrated), by Henry J. Slack; The Scientific Aspect of "Free-Will," by Albert J. Leffingwell, M.D.; Experimental Legislation, by Prof. W. Stanley Jevons; Curious Ways of Getting Food (illustrated), by Herman L. Fairchild; The Pleasure of Visual Form (I.), by James Sully; The Crayfish (illustrated), by Prof. E. Ray Lankester; Learning to Write; A Consideration of Suicide, by J. H. Hopkins; Vegetable Phosphorescence, by Ellen Prescott; Croll's "Climate and Time," by W. J. McGee; A Living Honeycomb; Size of Brain and Size of Body, by H. W. B.; The Textile Plants of the World; Sketch of Dr. Charles F. Chandler (with portrait); Correspondence, Editor's Table, Literary Notices, Popular Miscellany, Notes.

THE April numbers of *Harper's Monthly*, *Appleton's Journal*, the *Atlantic*, the *American Naturalist*, the *Phrenological Journal*, Boston *Journal of Chemistry*, etc., etc., have all been received, and all seem to greet the return of spring with especially appropriate and attractive articles.

Le Technologiste, edited by M. Louis Lockert, 35 Rue Oberkamp, Paris, is now in its fortieth year, and is consequently one of the oldest as well as ablest technical publications of France. Published weekly, 25 francs per annum.

ST. LOUIS (Free) Library

DIAMOND DRUG STORE,

A large assortment of Fine Toilet Goods, Perfumery, Toilet Soaps, Sponges, Etc. Trusses, and Supporters, Homœopathic Medicines and Specifics constantly on hand.

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THE NEW HECLA FOR 1880

With the Combination Duplex Grate----Elegant, Artistic, Complete.

Important and valuable improvements, both in construction and design.

New nickel trimmings of the most elaborate and tasteful character, embracing a broad nickel-plated ring on the top rim of the stove, and nickel-plated name-plates, both on the base and directly above the mica section.

A new fire-pot of increased capacity and most approved construction, a is great improvement on that of last year, being made much deeper and straighter.

The combination duplex grate is the crowning feature of the Hecla this season. It removes the ashes and clinkers thoroughly; it requires no poking or raking; it wastes no coal, it makes no dust.

Kansas City, Aug. 8th, 1879.

Mr. James Redheffer:

Dear Sir—Respecting the good qualities of the New Hecla, with the Duplex Grate, purchased of you last winter, it is a simple matter of justice to say, that it gave great satisfaction during the coldest weather, and was specially appreciated, because of its simple and easy management, its easy adaptation to change in outside temperature, and withal its beauty of design. In short it is the very best stove all things considered that I have ever seen. Yours truly,

B. F. JONES,
Sup't Water Works.

Kansas City, Aug. 10th, 1879.

James Redheffer, Esq.:

Dear Sir—In answer to yours of Aug. 9th, in quiring how I liked the New Hecla Hard Coal Stove, with Duplex Grate bought of you last winter, would say in reply, that I deem it the very best Base Burning Hard Coal Stove in use and it has given me entire satisfaction.

J. R. SNELL.

Kansas City, Mo., Aug. 10th, 1879.

Mr. James Redheffer:

Dear Sir—Replying to your inquiry as to how we were pleased with the New Hecla, would say that it proved all that you represented it. Used it last winter in our office, found it economical in the use of fuel, easy to regulate, keeping up an even temperature during all the severe weather. Have also one at my residence, am entirely satisfied with it, take great pleasure in recommencing it. Consider the Duplex the *ne plus ultra* of grate.

Respectfully yours, I. M. SMITH, Cash'r,
Bank of Kansas City.

Kansas City, Aug 9th, 1879.

Jas. Redheffer, Esq.,

Dear Sir—The Hecla Base Burner bought of you last season proved to be all you claimed for it, being a great heater, easy to manage and economical in the use of fuel.

THOMAS GREEN,
Wholesale Grocer.

Kansas City, Aug. 11th, 1879.

Mr. James Redheffer:

Dear Sir—The number 16 Hecla with Duplex Grate bought of you last season gave me perfect satisfaction. Is so easy to manage and heats my whole house. I consider it the best stove made.

Yours truly, A. B. MATTHEWS,
Stock Dealer.

Kansas City, Aug. 11th, 1879.

Mr. Jas. Redheffer:

Dear Sir—Have used a variety of Base Burners, but never any to compare with the Hecla. Can cheerfully recommend it to all in need of a first class stove.

Yours truly, W. H. KNOTTS.

Kansas City, Sept. 16.

Mr. James Redheffer:

Dear Sir—In answer to your inquiry of to-day, asking me how I liked the New Hecla, with Duplex Grate, bought of you last winter, I can cheerfully say in reply that I have been familiar with hard coal base burners many years, and I regard the New Hecla the very best stove in use. Gives me perfect satisfaction.

D. S. PATTERSON.

James Redheffer:

Dear Sir—I used one of your No. 16 Heclas last winter, am well pleased with it—best stove in use.

GEO. W. STROPE,
Western Manager for the sale of Pianos.

Kansas City, Sept. 20, 1879.

James Redheffer:

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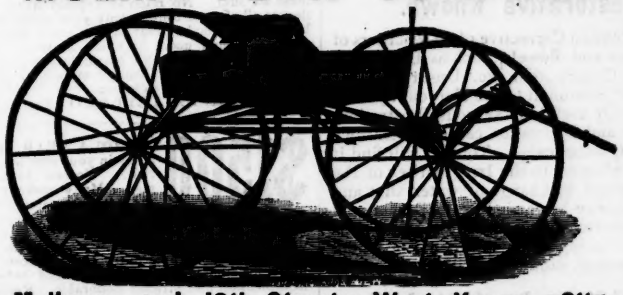

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